FIG.1

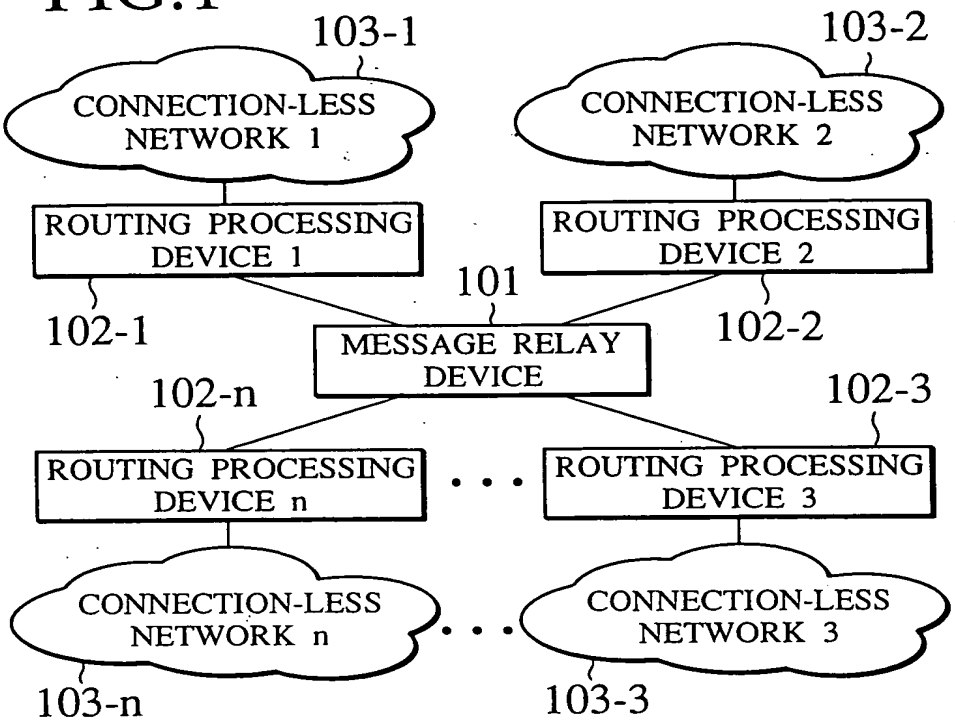

103-1
CONNECTION-LESS NETWORK 1
103-2
CONNECTION-LESS NETWORK 2
ROUTING PROCESSING DEVICE 1
ROUTING PROCESSING DEVICE 2
101
102-1
MESSAGE RELAY DEVICE
102-2
102-n
102-3
ROUTING PROCESSING DEVICE n
ROUTING PROCESSING DEVICE 3
CONNECTION-LESS NETWORK n
CONNECTION-LESS NETWORK 3
103-n
103-3

FIG.2

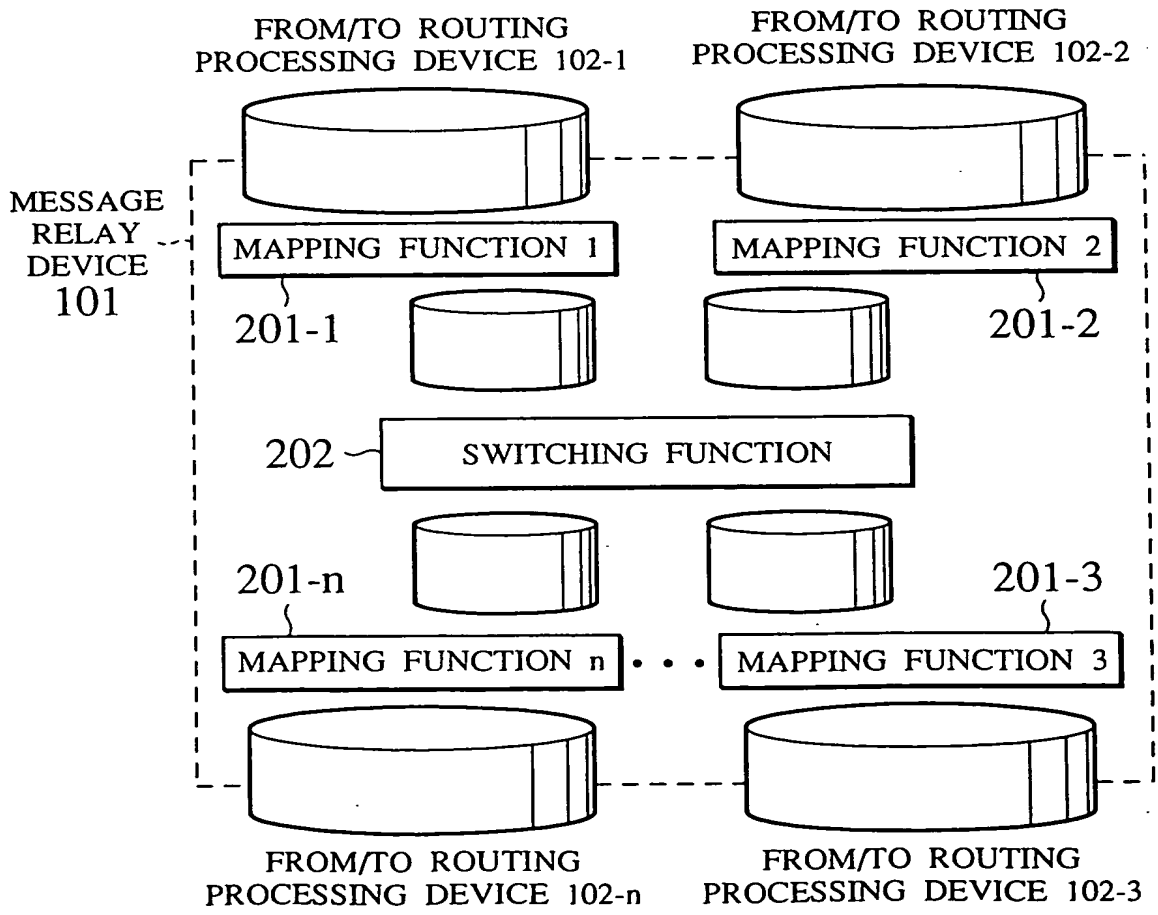

FROM/TO ROUTING PROCESSING DEVICE 102-1
FROM/TO ROUTING PROCESSING DEVICE 102-2
MESSAGE RELAY DEVICE 101
MAPPING FUNCTION 1
MAPPING FUNCTION 2
201-1
201-2
202
SWITCHING FUNCTION
201-n
201-3
MAPPING FUNCTION n
MAPPING FUNCTION 3
FROM/TO ROUTING PROCESSING DEVICE 102-n
FROM/TO ROUTING PROCESSING DEVICE 102-3

FIG.3

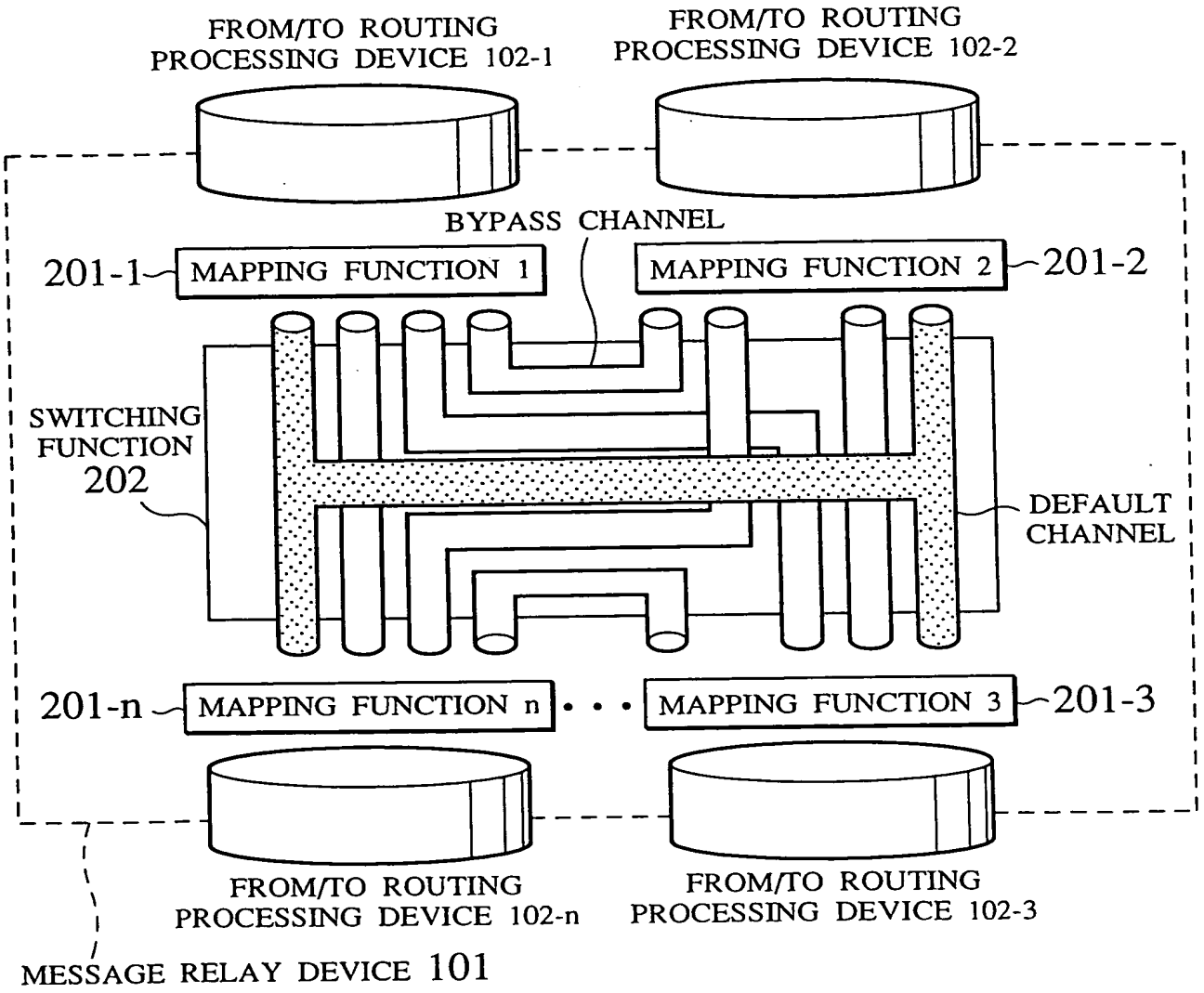

FROM/TO ROUTING PROCESSING DEVICE 102-1
FROM/TO ROUTING PROCESSING DEVICE 102-2
BYPASS CHANNEL
201-1
MAPPING FUNCTION 1
MAPPING FUNCTION 2
201-2
SWITCHING FUNCTION 202
DEFAULT CHANNEL
201-n
MAPPING FUNCTION n
MAPPING FUNCTION 3
201-3
FROM/TO ROUTING PROCESSING DEVICE 102-n
FROM/TO ROUTING PROCESSING DEVICE 102-3
MESSAGE RELAY DEVICE 101

FIG.4

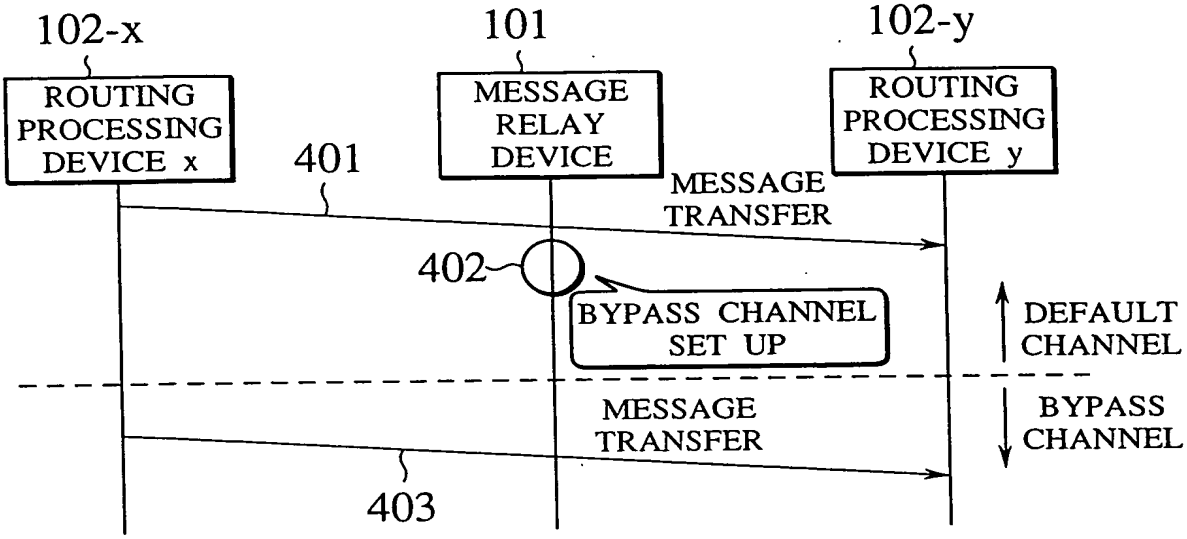
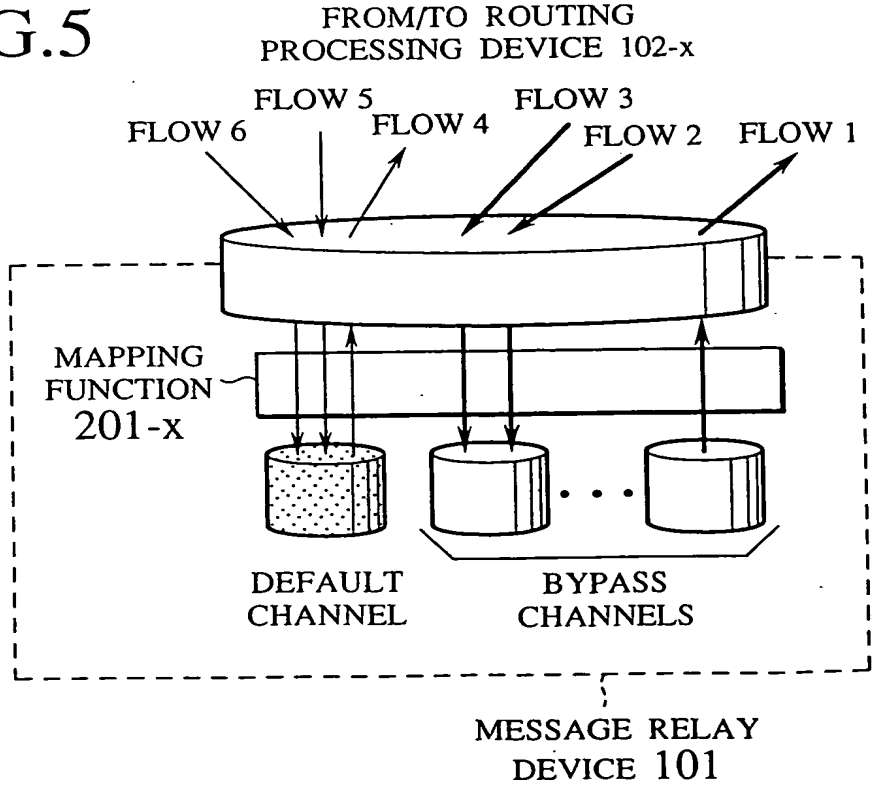

102-x
ROUTING PROCESSING DEVICE x
101
MESSAGE RELAY DEVICE
102-y
ROUTING PROCESSING DEVICE y
401
MESSAGE TRANSFER
402
BYPASS CHANNEL SET UP
DEFAULT CHANNEL
BYPASS CHANNEL
MESSAGE TRANSFER
403

FIG.5


FROM/TO ROUTING PROCESSING DEVICE 102-x
FLOW 6
FLOW 5
FLOW 4
FLOW 3
FLOW 2
FLOW 1
MAPPING FUNCTION 201-x
DEFAULT CHANNEL
BYPASS CHANNELS
MESSAGE RELAY DEVICE 101

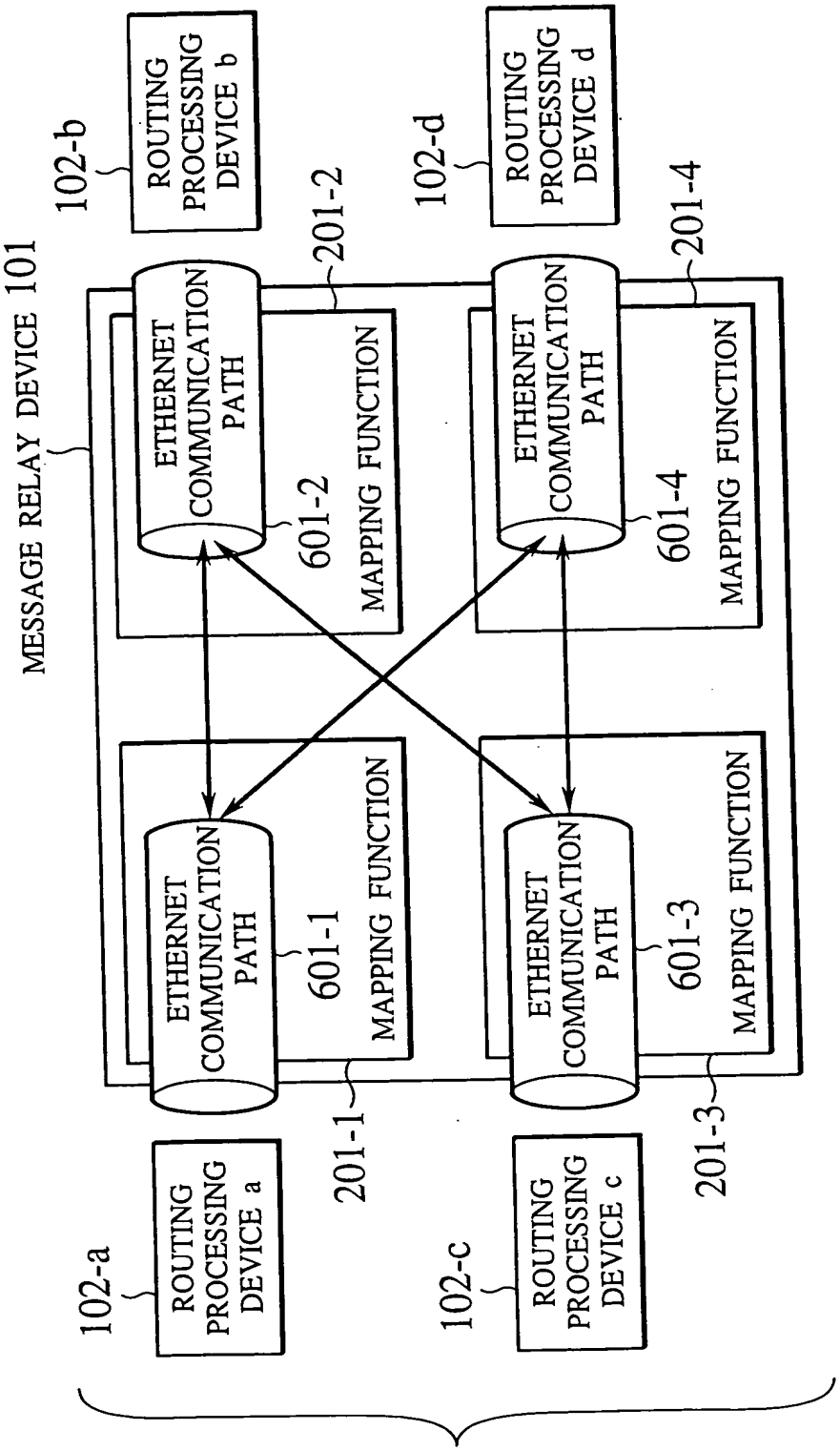

MESSAGE RELAY DEVICE 101
ROUTING PROCESSING DEVICE a
102-a
ROUTING PROCESSING DEVICE b
102-b
ROUTING PROCESSING DEVICE c
102-c
ROUTING PROCESSING DEVICE d
102-d
ETHERNET COMMUNICATION PATH
201-1
201-2
201-3
201-4
MAPPING FUNCTION
601-1
601-2
601-3
601-4

FIG.6

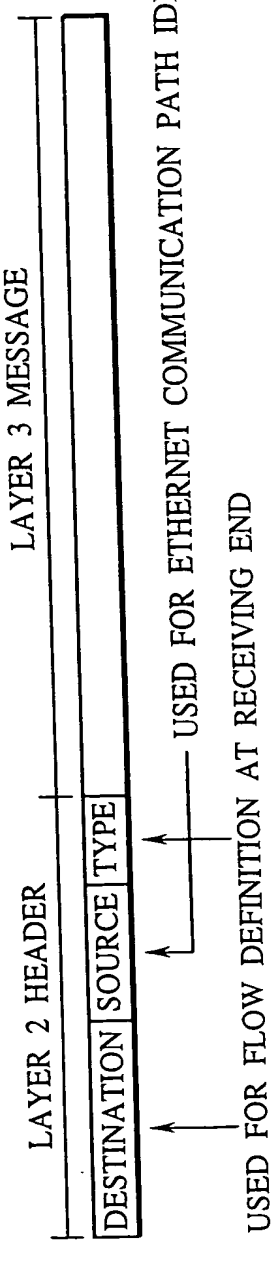

LAYER 3 MESSAGE
LAYER 2 HEADER
DESTINATION
SOURCE
TYPE
USED FOR ETHERNET COMMUNICATION PATH IDENTIFICATION
USED FOR FLOW DEFINITION AT RECEIVING END

FIG.7

FIG.8

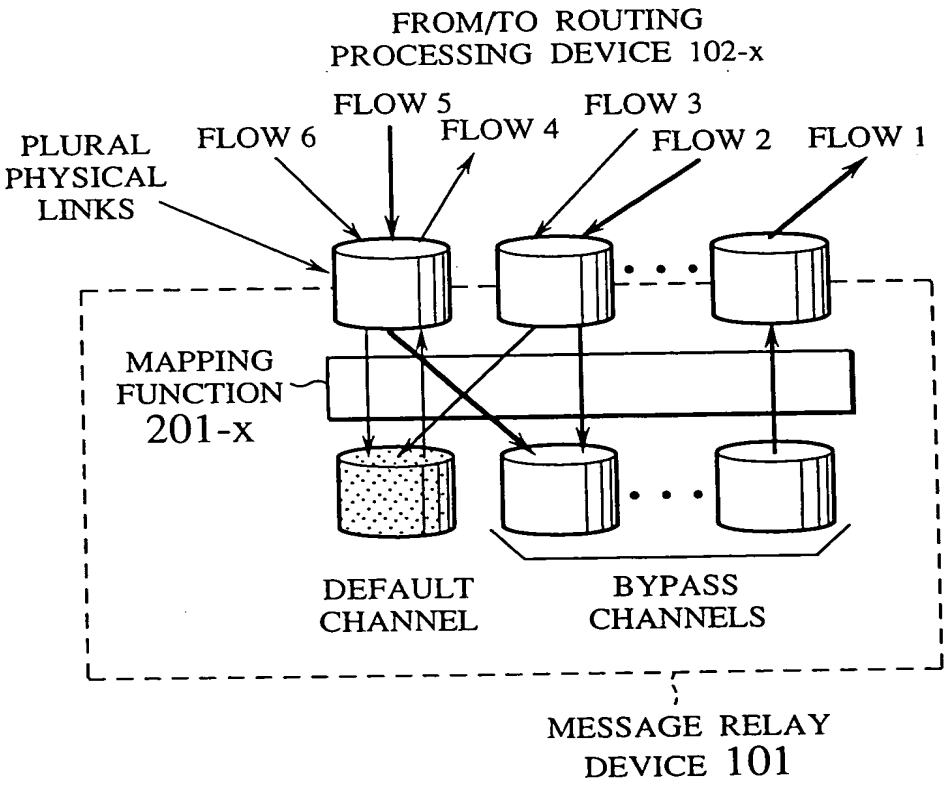

FROM/TO ROUTING PROCESSING DEVICE 102-x
FLOW 5
FLOW 3
FLOW 6
FLOW 4
FLOW 2
FLOW 1
PLURAL PHYSICAL LINKS
MAPPING FUNCTION 201-x
DEFAULT CHANNEL
BYPASS CHANNELS
MESSAGE RELAY DEVICE 101

FIG.9

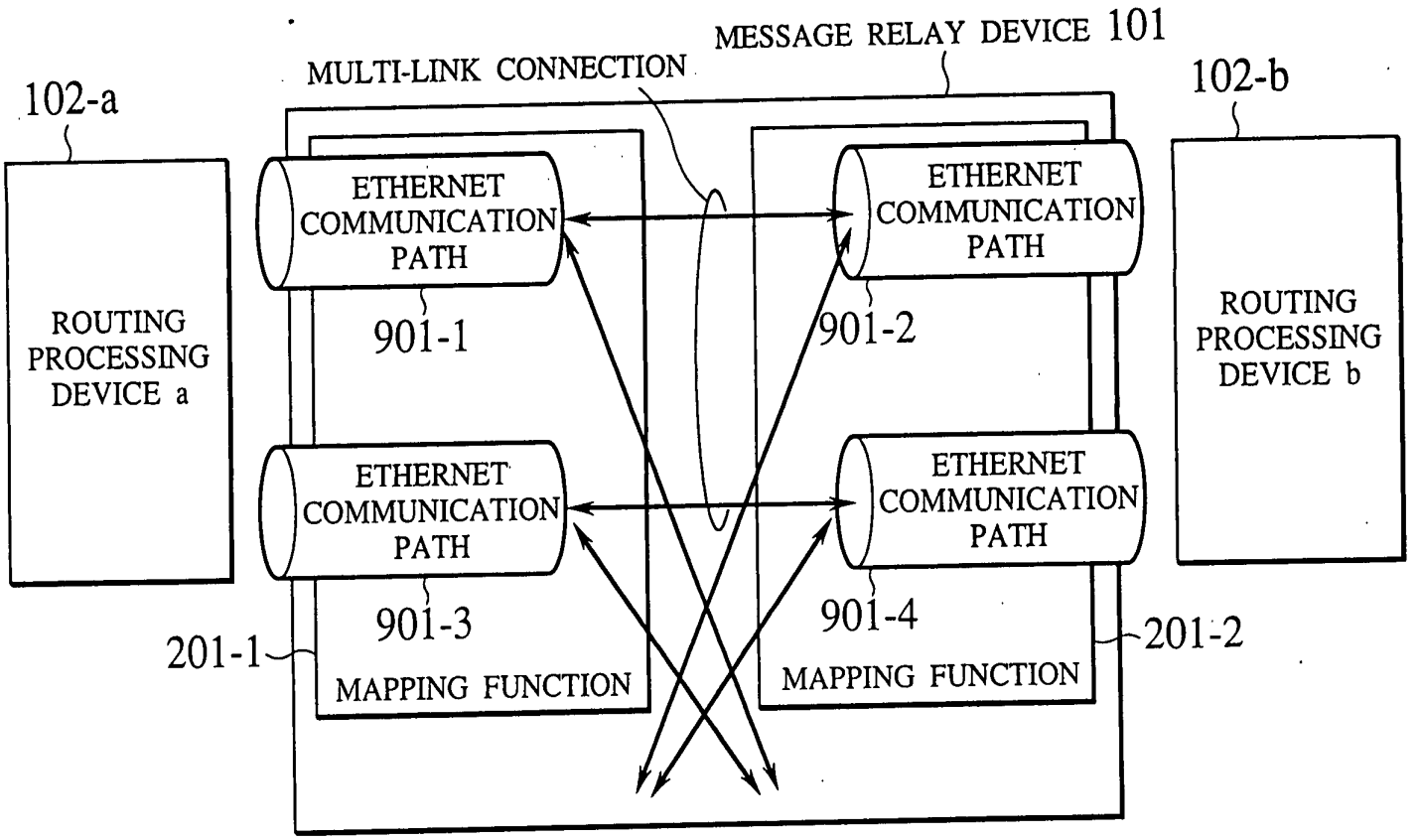
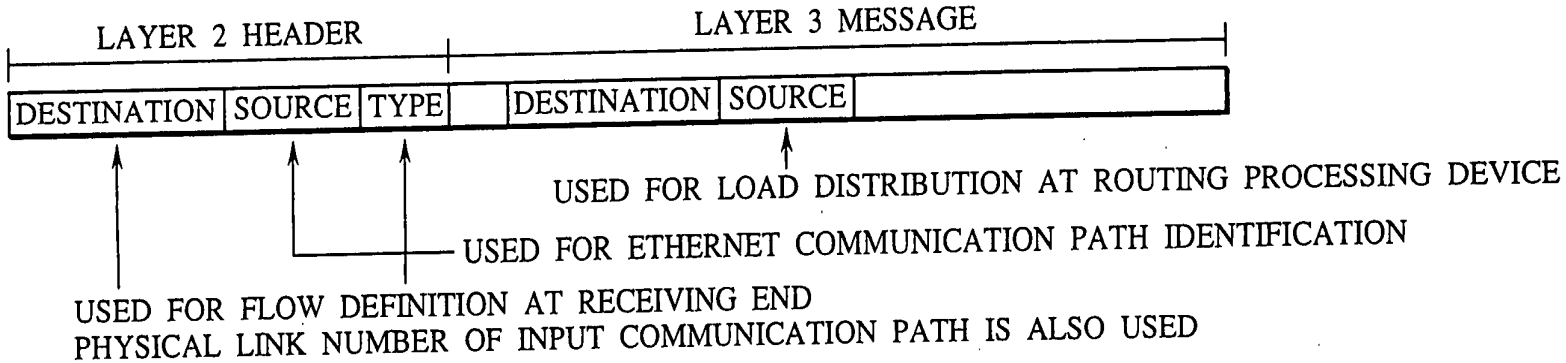


FIG.10



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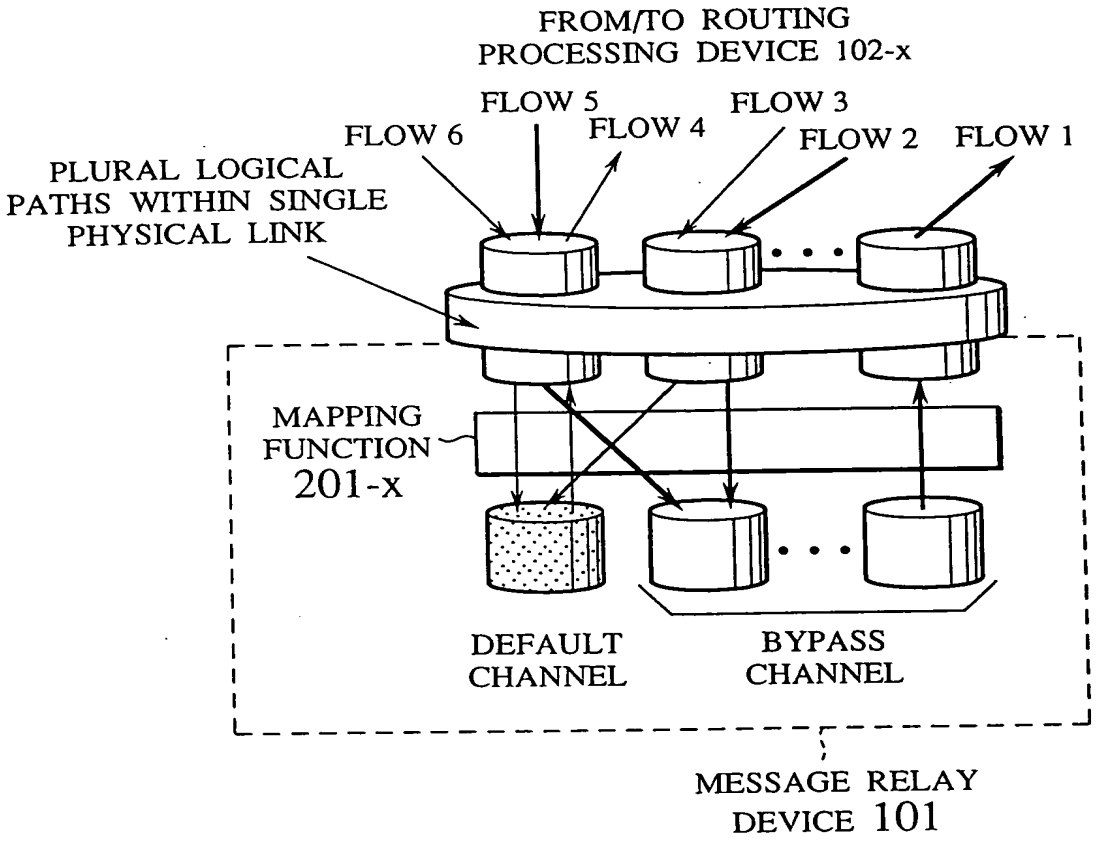
Inventor(s): Yasuro SHOBATAKE
DOCKET NO.: 040301-0641

FIG.11


FROM/TO ROUTING PROCESSING DEVICE 102-x
FLOW 5
FLOW 3
FLOW 6
FLOW 4
FLOW 2
FLOW 1
PLURAL LOGICAL PATHS WITHIN SINGLE PHYSICAL LINK
MAPPING FUNCTION 201-x
DEFAULT CHANNEL
BYPASS CHANNEL
MESSAGE RELAY DEVICE 101

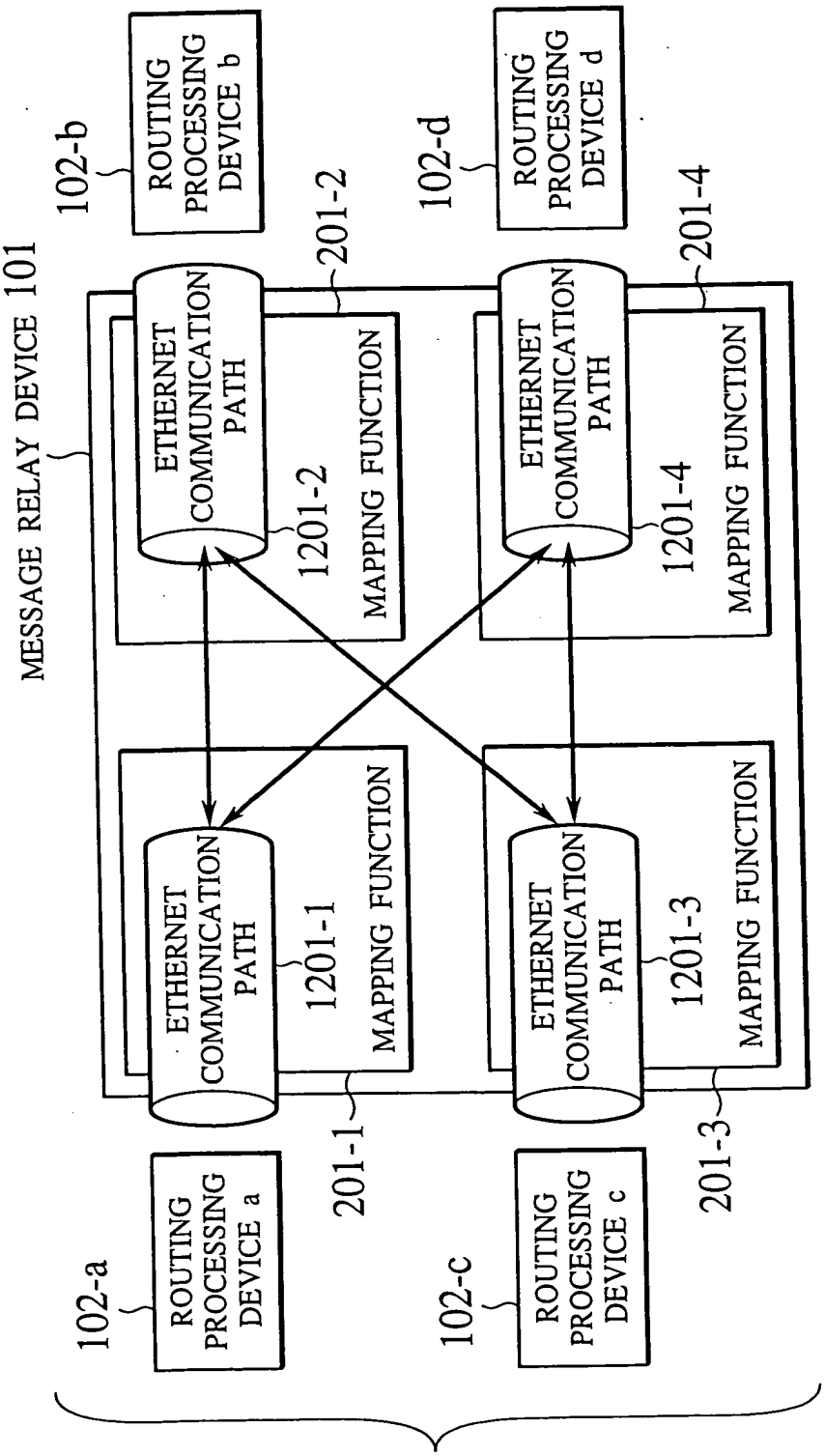

MESSAGE RELAY DEVICE 101
102-a
ROUTING PROCESSING DEVICE a
102-b
ROUTING PROCESSING DEVICE b
102-c
ROUTING PROCESSING DEVICE c
102-d
ROUTING PROCESSING DEVICE d
201-1
201-2
201-3
201-4
ETHERNET COMMUNICATION PATH
1201-1
1201-2
1201-3
1201-4
MAPPING FUNCTION

FIG.12

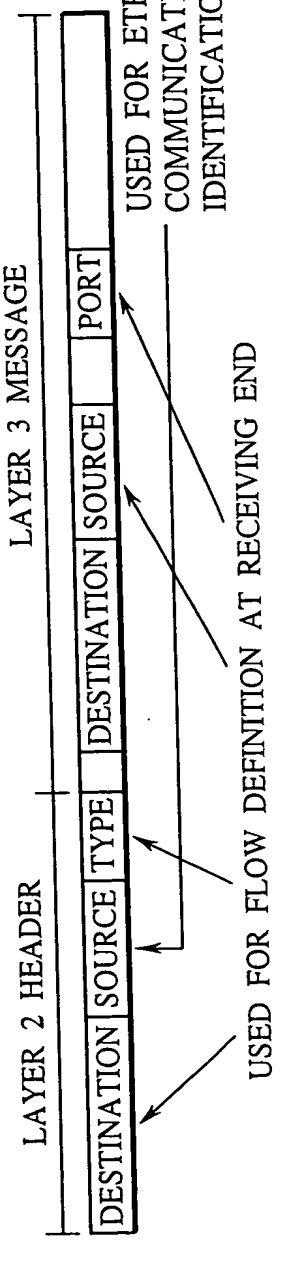
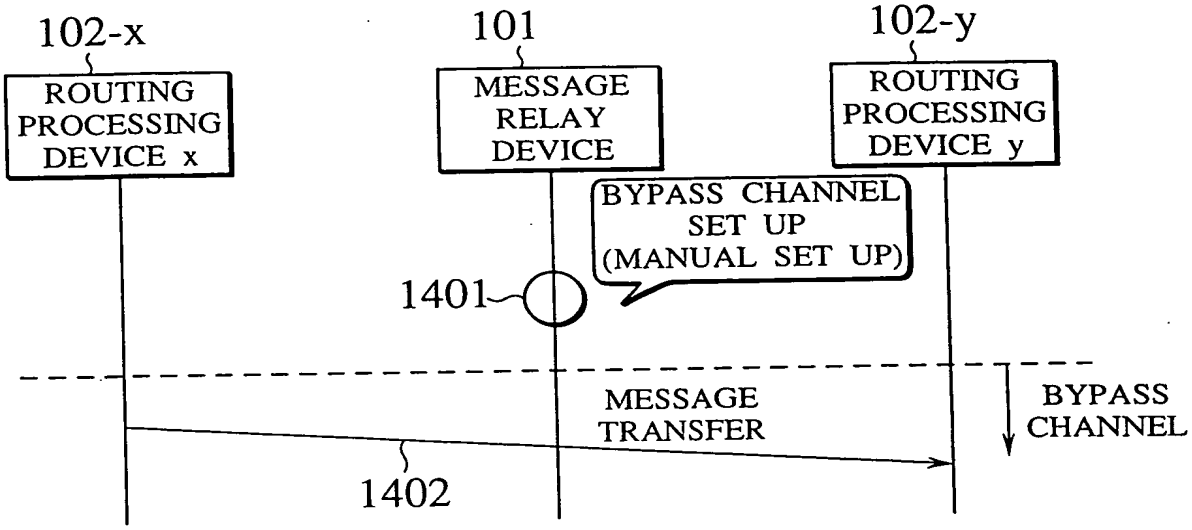

LAYER 3 MESSAGE
LAYER 2 HEADER
DESTINATION
SOURCE
TYPE
DESTINATION
SOURCE
PORT
USED FOR ETHERNET COMMUNICATION PATH IDENTIFICATION
USED FOR FLOW DEFINITION AT RECEIVING END

FIG.13

FIG.14


102-x
ROUTING PROCESSING DEVICE x
101
MESSAGE RELAY DEVICE
102-y
ROUTING PROCESSING DEVICE y
BYPASS CHANNEL SET UP (MANUAL SET UP)
1401
MESSAGE TRANSFER
BYPASS CHANNEL
1402

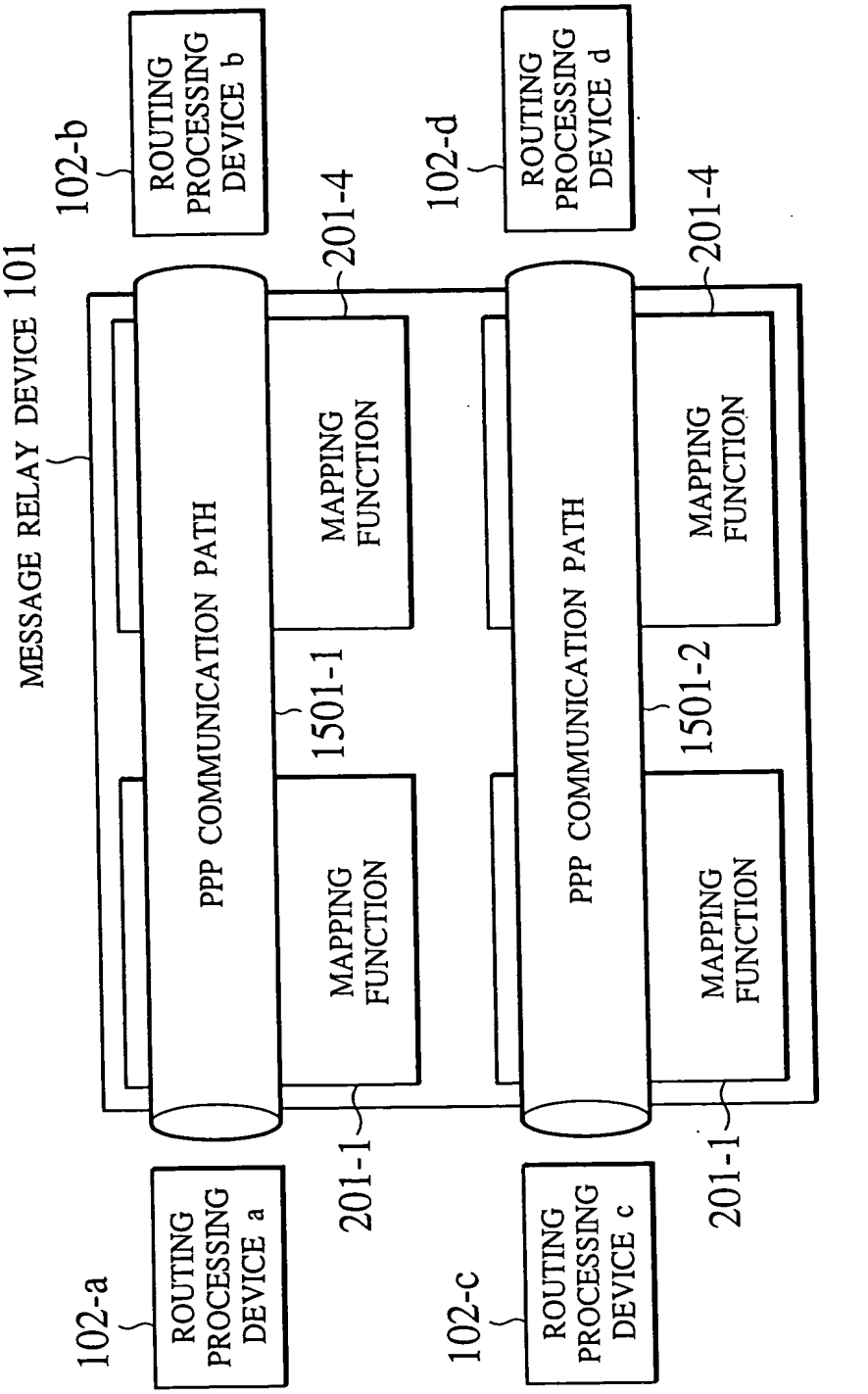

MESSAGE RELAY DEVICE 101
102-a
ROUTING PROCESSING DEVICE a
102-b
ROUTING PROCESSING DEVICE b
102-c
ROUTING PROCESSING DEVICE c
102-d
ROUTING PROCESSING DEVICE d
PPP COMMUNICATION PATH
PPP COMMUNICATION PATH
MAPPING FUNCTION
MAPPING FUNCTION
MAPPING FUNCTION
MAPPING FUNCTION
201-1
201-1
201-4
201-4
1501-1
1501-2

FIG.15

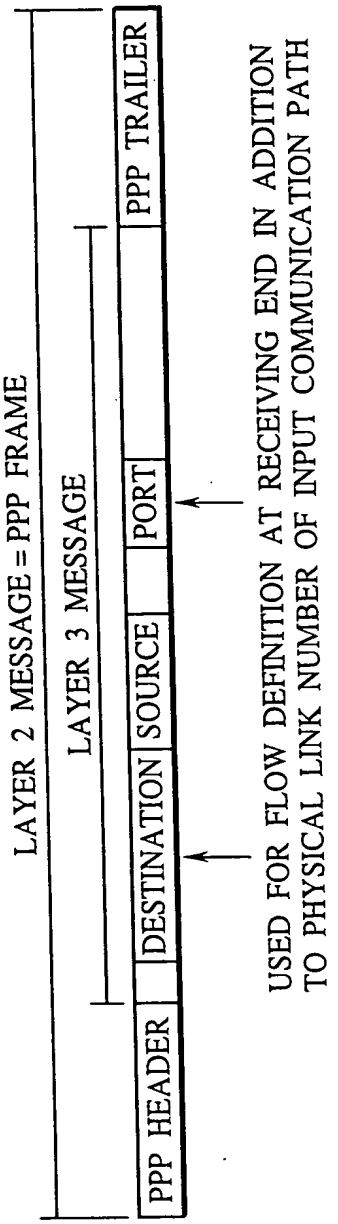

LAYER 2 MESSAGE = PPP FRAME
LAYER 3 MESSAGE
PPP HEADER
DESTINATION
SOURCE
PORT
PPP TRAILER
USED FOR FLOW DEFINITION AT RECEIVING END IN ADDITION
TO PHYSICAL LINK NUMBER OF INPUT COMMUNICATION PATH

FIG.16

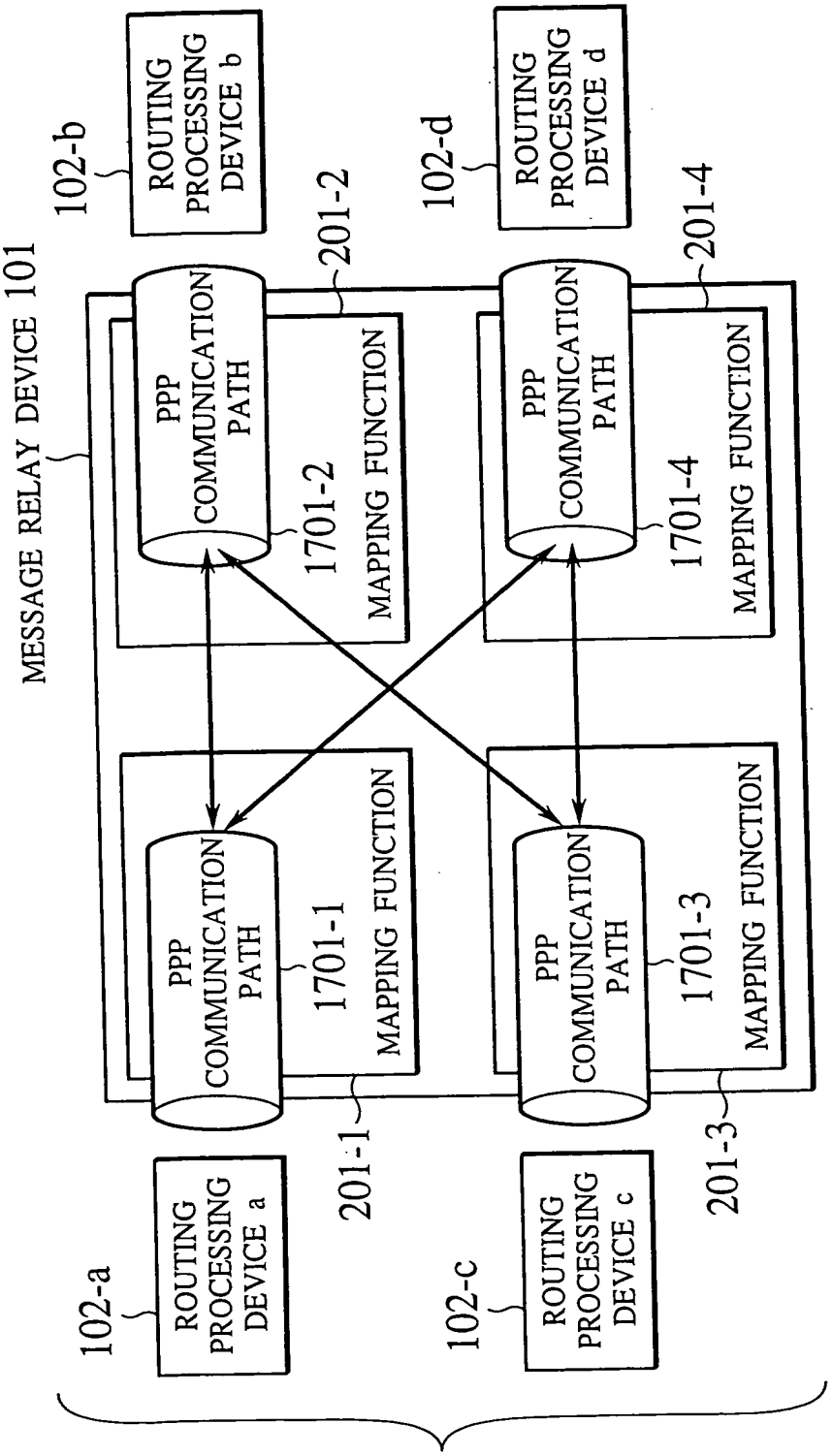

MESSAGE RELAY DEVICE 101
102-a
ROUTING PROCESSING DEVICE a
102-b
ROUTING PROCESSING DEVICE b
102-c
ROUTING PROCESSING DEVICE c
102-d
ROUTING PROCESSING DEVICE d
201-1
201-2
201-3
201-4
PPP COMMUNICATION PATH
1701-1
1701-2
1701-3
1701-4
MAPPING FUNCTION

FIG.17

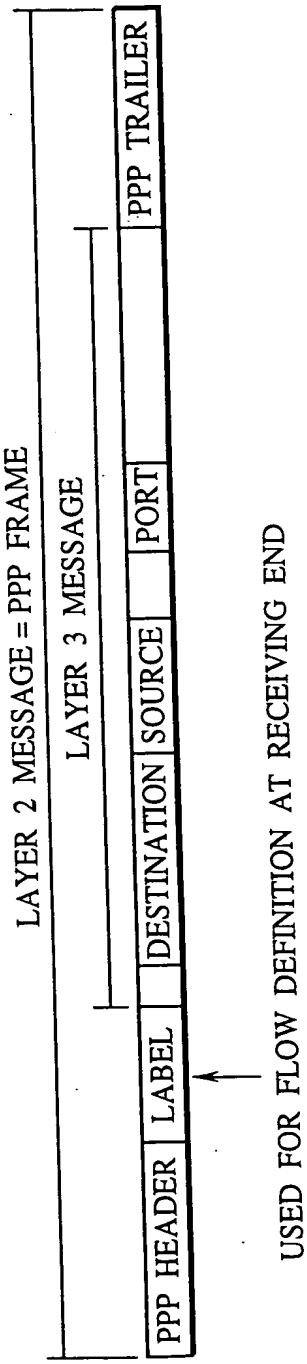

LAYER 2 MESSAGE = PPP FRAME
LAYER 3 MESSAGE
PPP HEADER
LABEL
DESTINATION
SOURCE
PORT
PPP TRAILER
USED FOR FLOW DEFINITION AT RECEIVING END

FIG.18

FIG.19

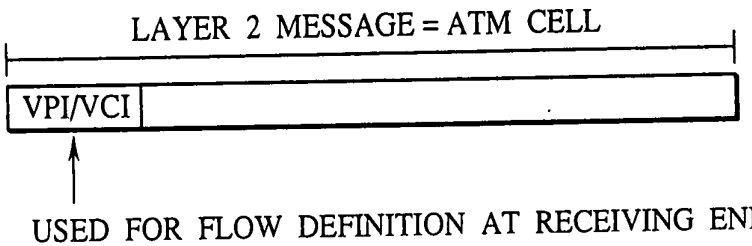
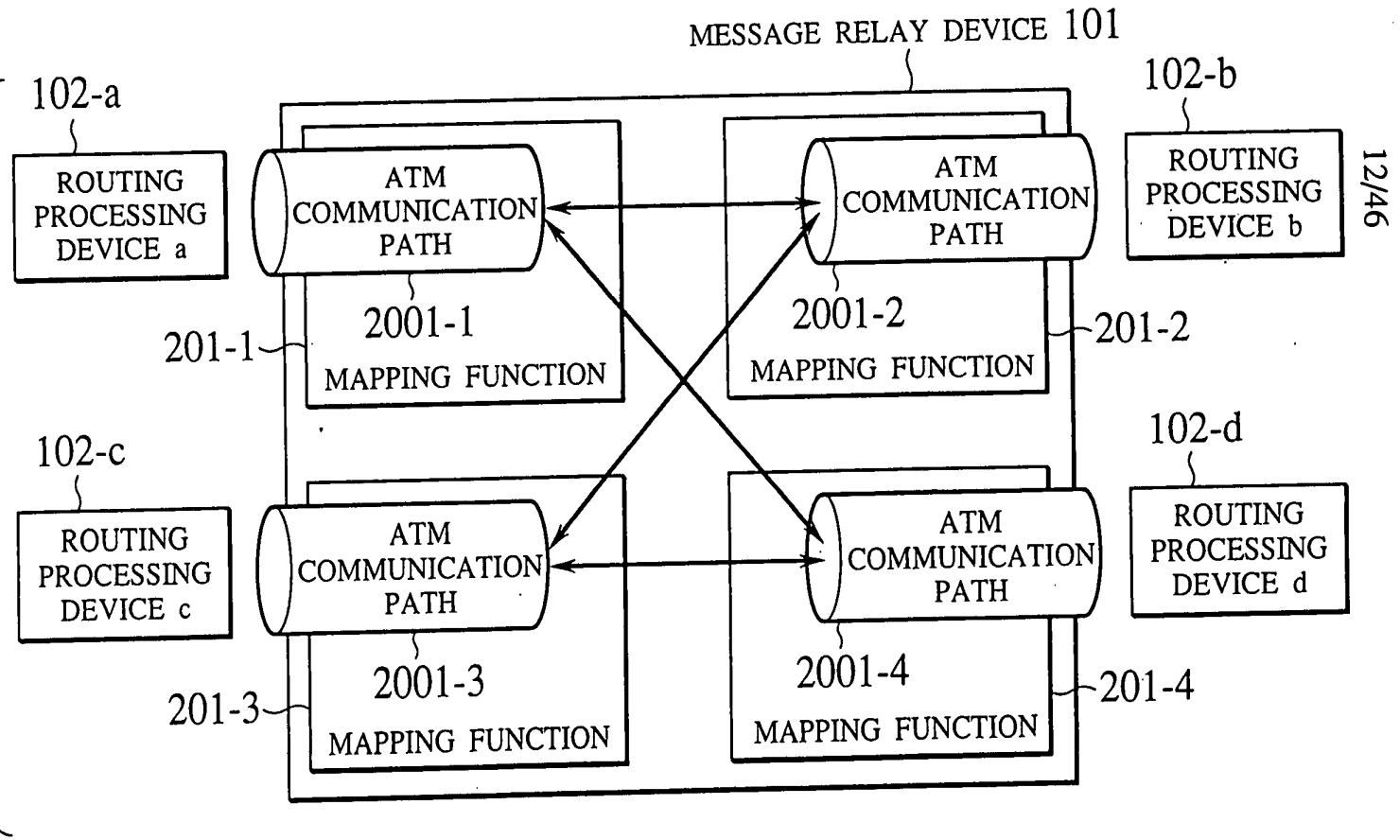


FIG.20



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Inventor(s): Yasuro SHOBATAKE
DOCKET NO.: 040301-0641

FIG.21

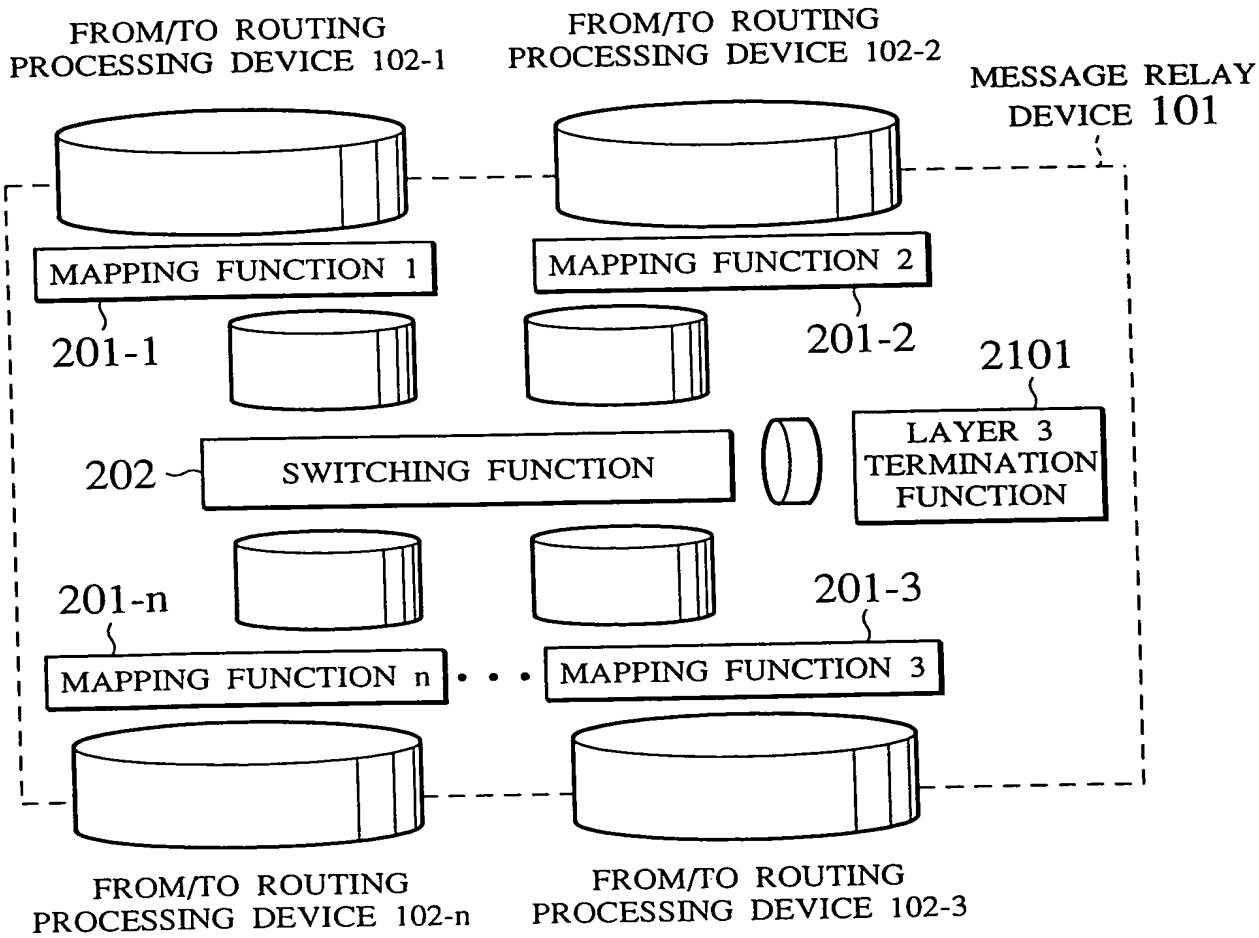

FROM/TO ROUTING PROCESSING DEVICE 102-1
FROM/TO ROUTING PROCESSING DEVICE 102-2
MESSAGE RELAY DEVICE 101
MAPPING FUNCTION 1
MAPPING FUNCTION 2
201-1
201-2
2101
202
SWITCHING FUNCTION
LAYER 3 TERMINATION FUNCTION
201-n
201-3
MAPPING FUNCTION n
MAPPING FUNCTION 3
FROM/TO ROUTING PROCESSING DEVICE 102-n
FROM/TO ROUTING PROCESSING DEVICE 102-3

FIG.22

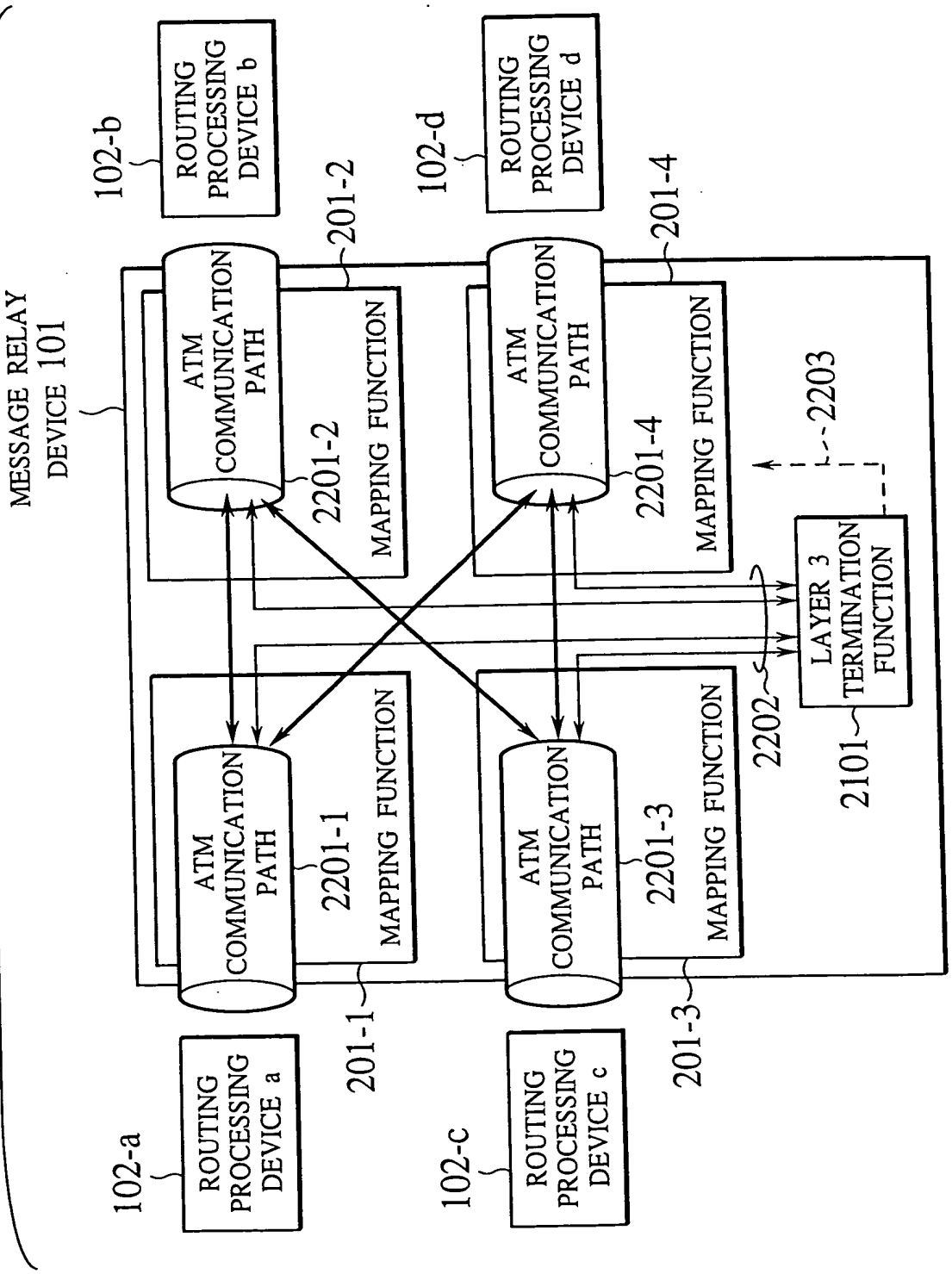

MESSAGE RELAY DEVICE 101
ROUTING PROCESSING DEVICE a
ROUTING PROCESSING DEVICE b
ROUTING PROCESSING DEVICE c
ROUTING PROCESSING DEVICE d
102-a
102-b
102-c
102-d
ATM COMMUNICATION PATH
MAPPING FUNCTION
201-1
201-2
201-3
201-4
2201-1
2201-2
2201-3
2201-4
LAYER 3 TERMINATION FUNCTION
2101
2202
2203

FIG.23

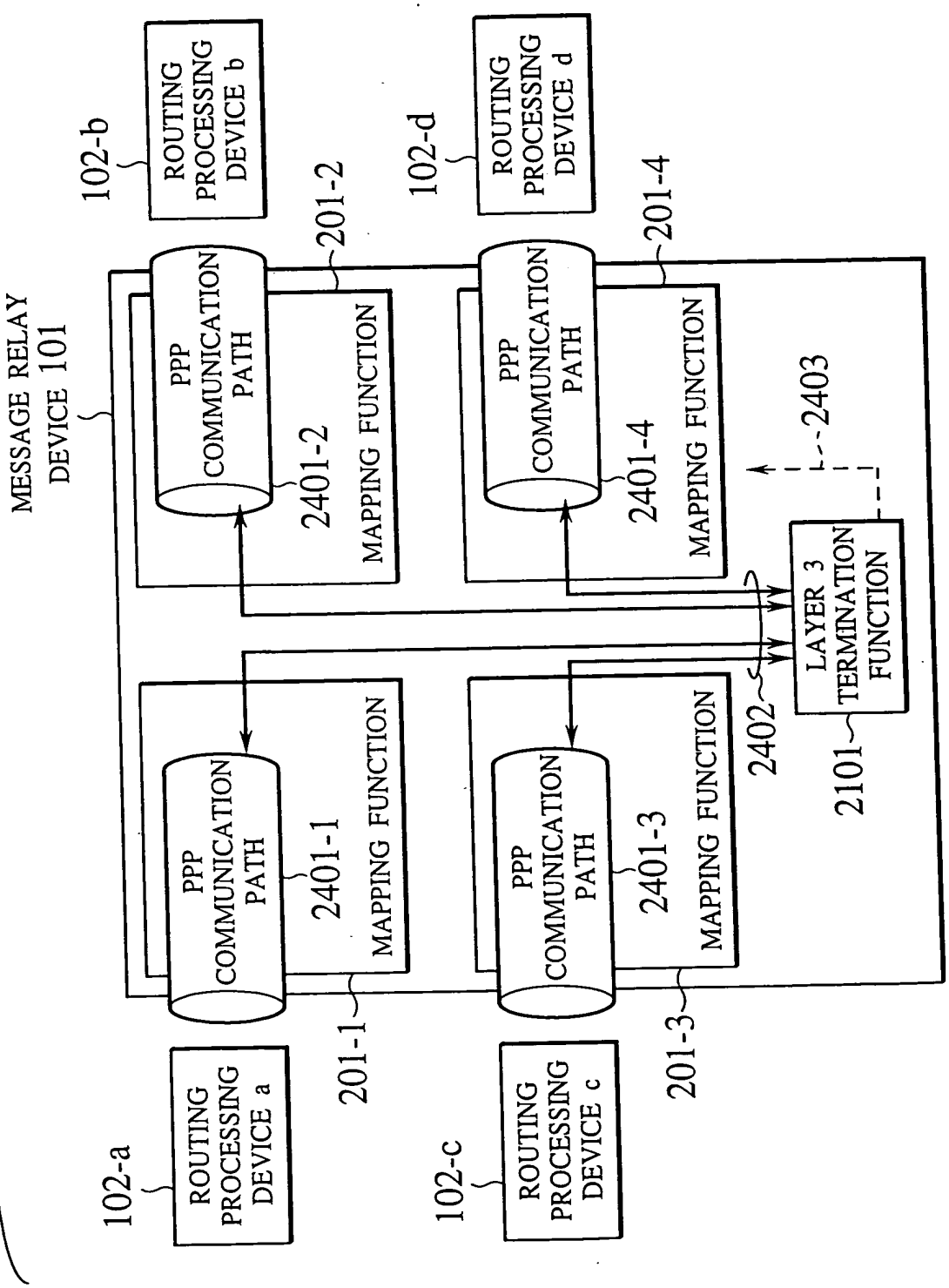

MESSAGE RELAY DEVICE 101
ROUTING PROCESSING DEVICE a
ROUTING PROCESSING DEVICE b
ROUTING PROCESSING DEVICE c
ROUTING PROCESSING DEVICE d
102-a
102-b
102-c
102-d
201-1
201-2
201-3
201-4
PPP COMMUNICATION PATH
2401-1
2401-2
2401-3
2401-4
MAPPING FUNCTION
2402
2403
LAYER 3 TERMINATION FUNCTION
2101

FIG.24

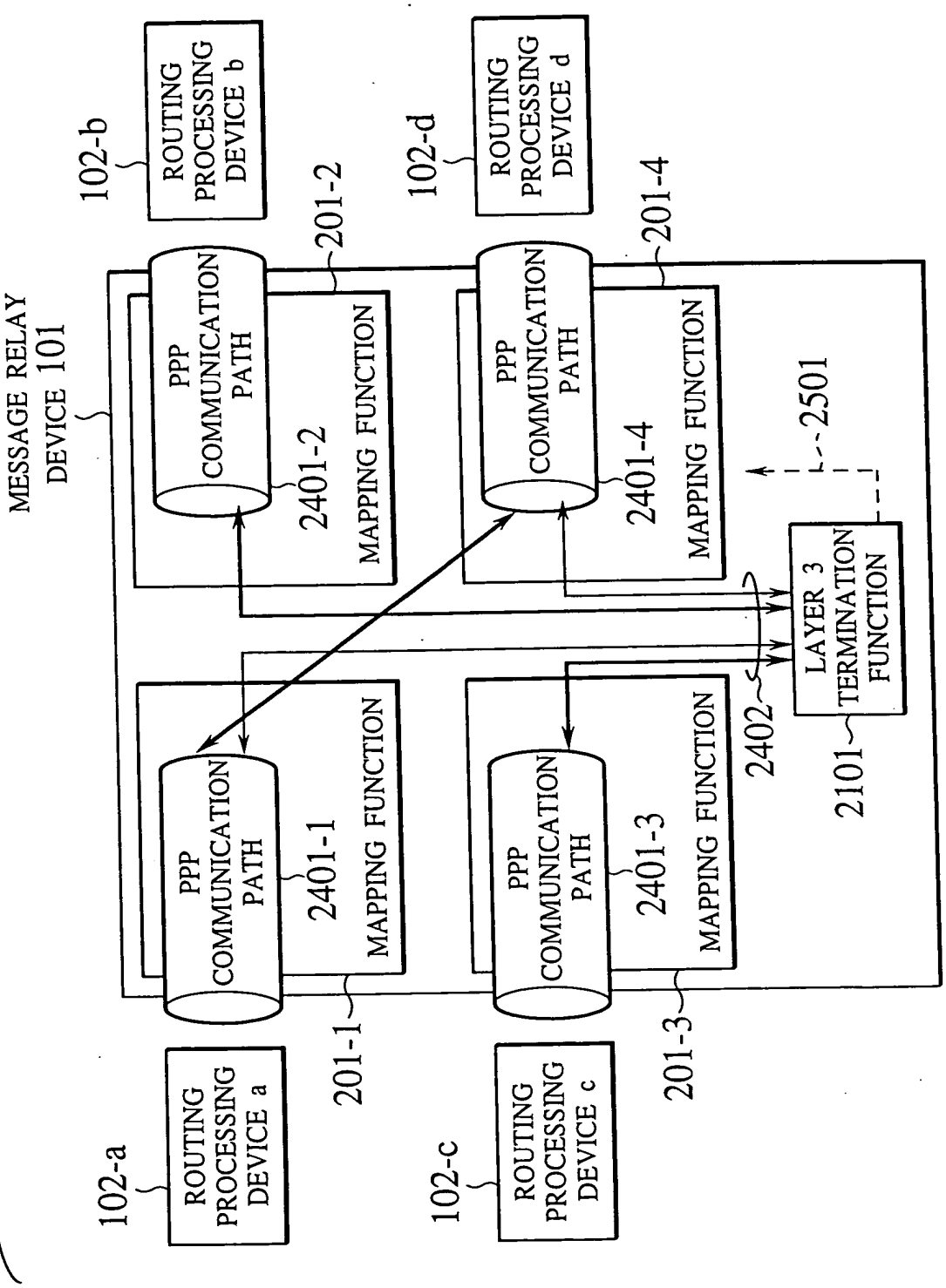

MESSAGE RELAY DEVICE 101
ROUTING PROCESSING DEVICE a
ROUTING PROCESSING DEVICE b
ROUTING PROCESSING DEVICE c
ROUTING PROCESSING DEVICE d
102-a
102-b
102-c
102-d
201-1
201-2
201-3
201-4
PPP COMMUNICATION PATH
MAPPING FUNCTION
2401-1
2401-2
2401-3
2401-4
LAYER 3 TERMINATION FUNCTION
2101
2402
2501

FIG.25

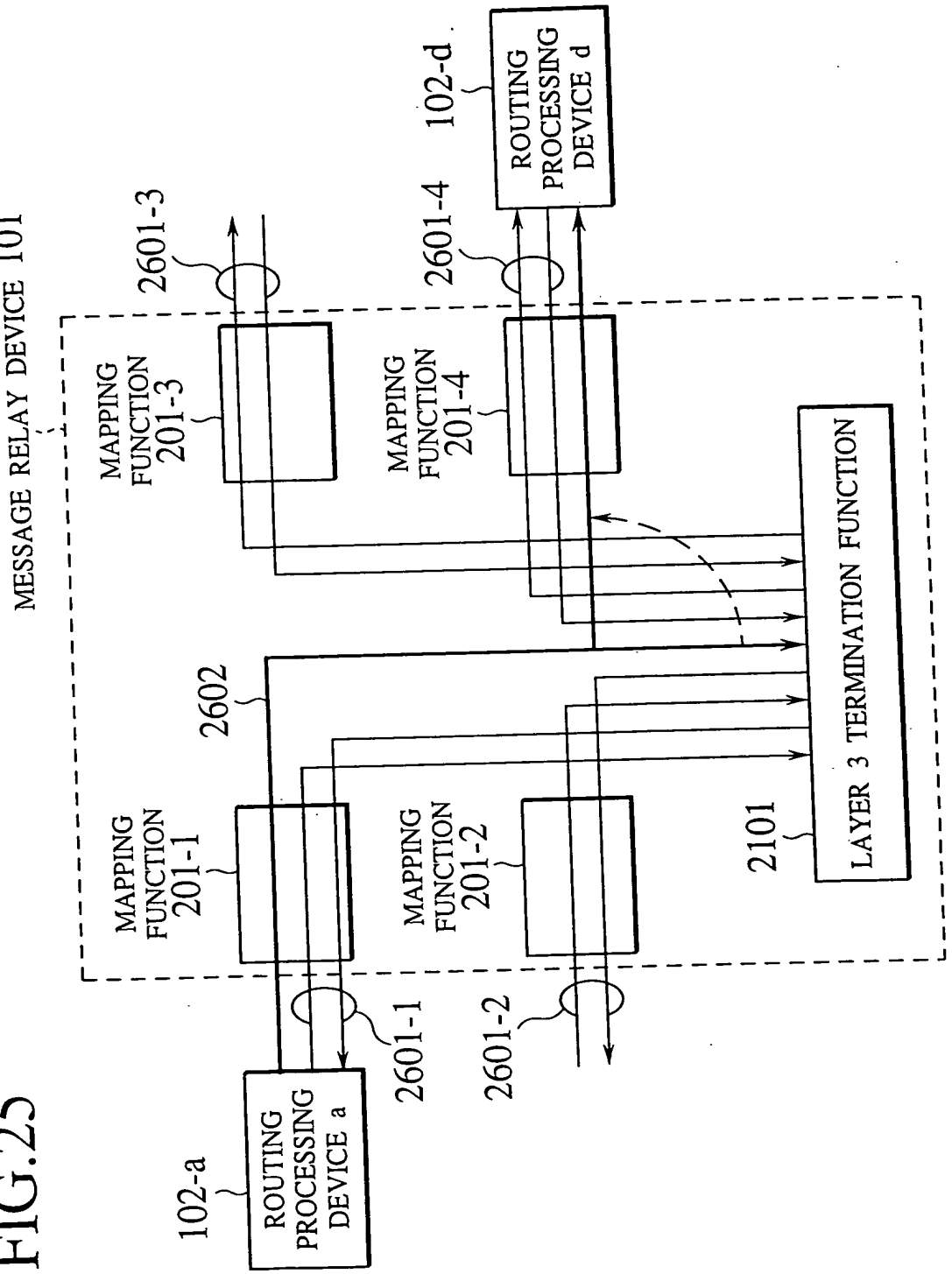

MESSAGE RELAY DEVICE 101
MAPPING FUNCTION 201-1
MAPPING FUNCTION 201-2
MAPPING FUNCTION 201-3
MAPPING FUNCTION 201-4
LAYER 3 TERMINATION FUNCTION
2101
2602
2601-1
2601-2
2601-3
2601-4
ROUTING PROCESSING DEVICE a
ROUTING PROCESSING DEVICE d
102-a
102-d

FIG.26

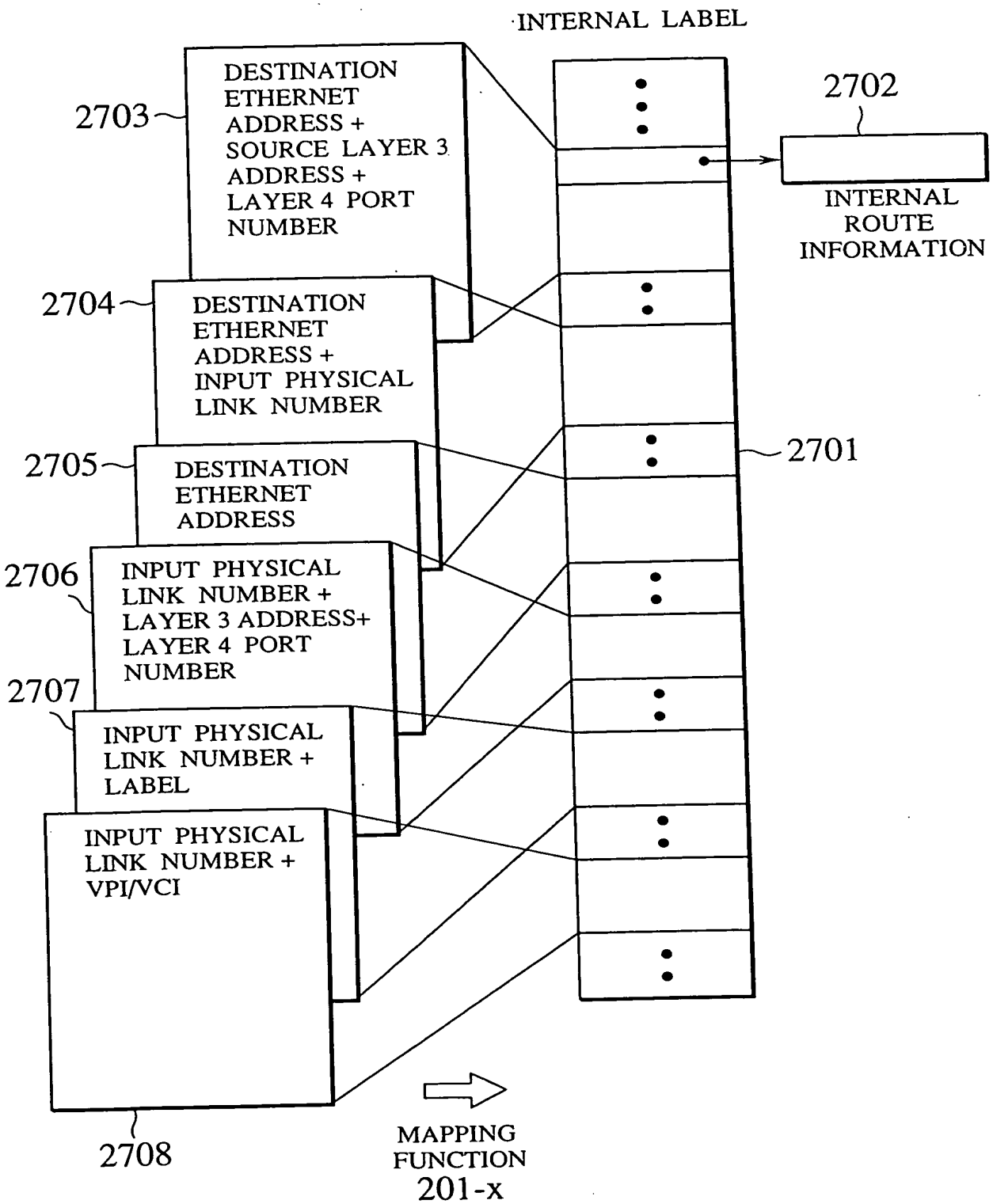

INTERNAL LABEL
2703
DESTINATION ETHERNET ADDRESS + SOURCE LAYER 3 ADDRESS + LAYER 4 PORT NUMBER
2702
INTERNAL ROUTE INFORMATION
2704
DESTINATION ETHERNET ADDRESS + INPUT PHYSICAL LINK NUMBER
2705
DESTINATION ETHERNET ADDRESS
2701
2706
INPUT PHYSICAL LINK NUMBER + LAYER 3 ADDRESS+ LAYER 4 PORT NUMBER
2707
INPUT PHYSICAL LINK NUMBER + LABEL
INPUT PHYSICAL LINK NUMBER + VPI/VCI
2708
MAPPING FUNCTION
201-x

FIG.27

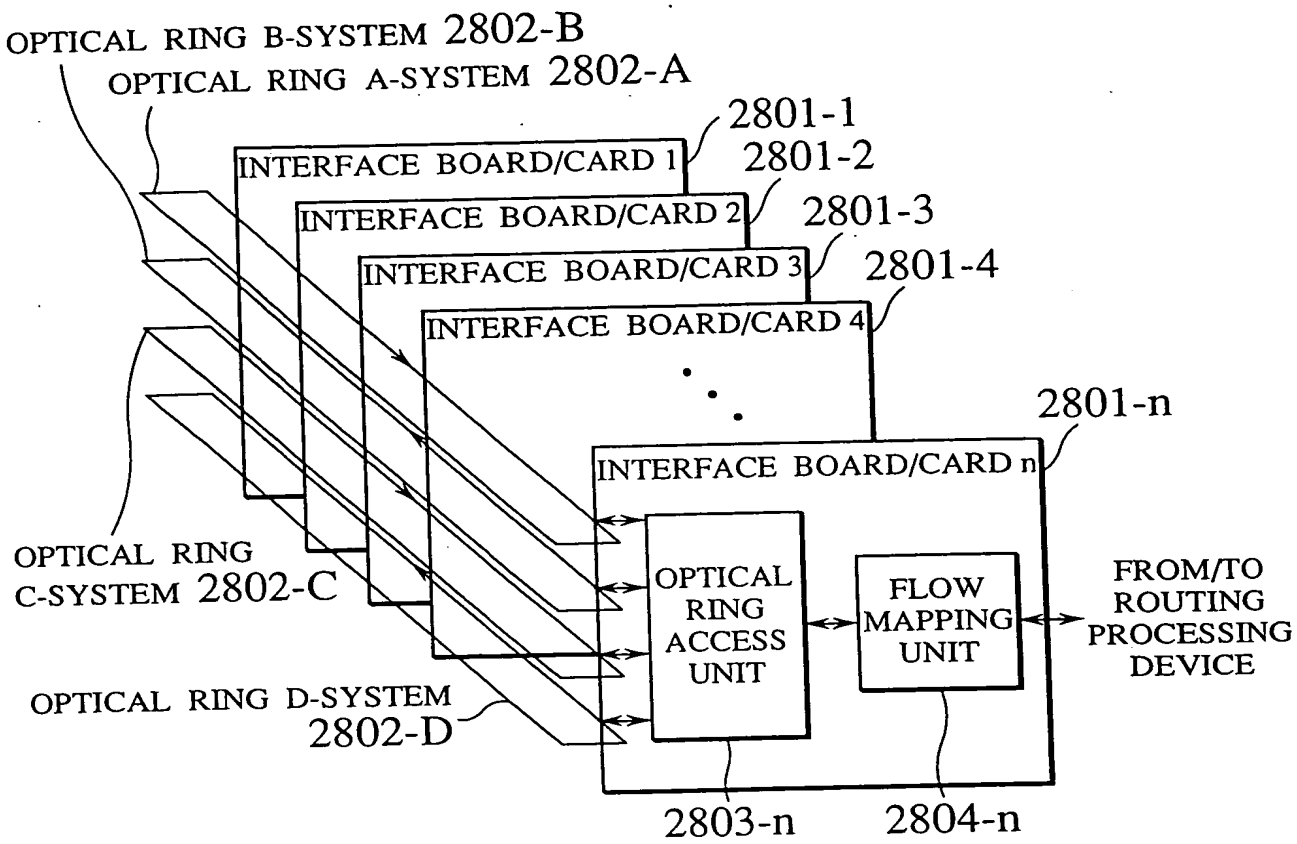

OPTICAL RING B-SYSTEM 2802-B
OPTICAL RING A-SYSTEM 2802-A
2801-1
INTERFACE BOARD/CARD 1
2801-2
INTERFACE BOARD/CARD 2
2801-3
INTERFACE BOARD/CARD 3
2801-4
INTERFACE BOARD/CARD 4
2801-n
INTERFACE BOARD/CARD n
OPTICAL RING C-SYSTEM 2802-C
OPTICAL RING ACCESS UNIT
FLOW MAPPING UNIT
FROM/TO ROUTING PROCESSING DEVICE
OPTICAL RING D-SYSTEM 2802-D
2803-n
2804-n

FIG.28

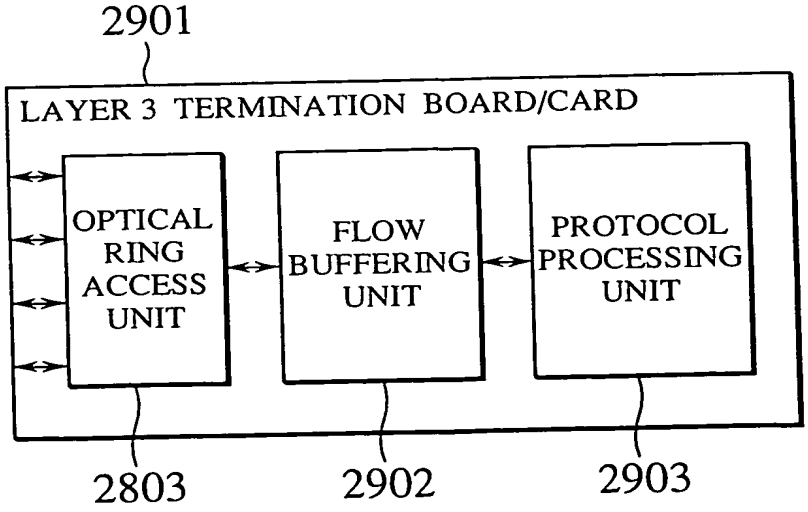

2901
LAYER 3 TERMINATION BOARD/CARD
OPTICAL RING ACCESS UNIT
FLOW BUFFERING UNIT
PROTOCOL PROCESSING UNIT
2803
2902
2903

FIG.29

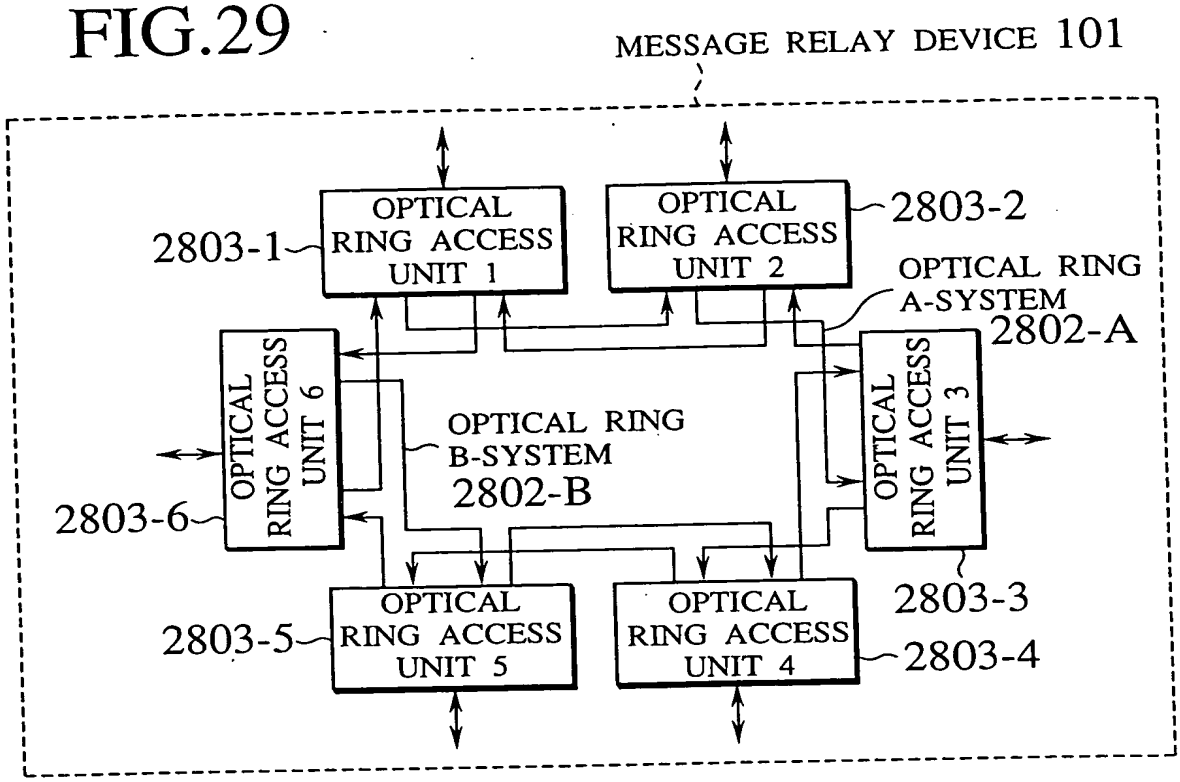

MESSAGE RELAY DEVICE 101
OPTICAL RING ACCESS UNIT 1
OPTICAL RING ACCESS UNIT 2
2803-1
2803-2
OPTICAL RING A-SYSTEM
2802-A
OPTICAL RING ACCESS UNIT 6
OPTICAL RING ACCESS UNIT 3
OPTICAL RING B-SYSTEM
2802-B
2803-6
2803-3
OPTICAL RING ACCESS UNIT 5
OPTICAL RING ACCESS UNIT 4
2803-5
2803-4

FIG.30

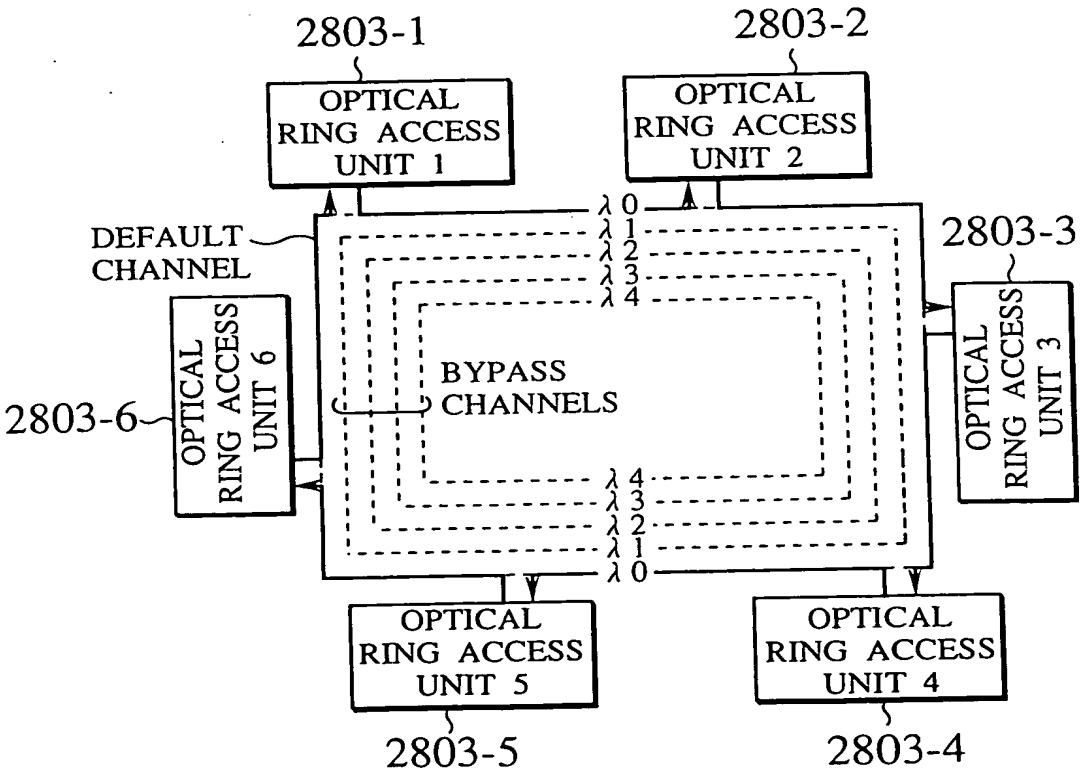

2803-1
2803-2
OPTICAL RING ACCESS UNIT 1
OPTICAL RING ACCESS UNIT 2
λ0
λ1
λ2
λ3
λ4
DEFAULT CHANNEL
2803-3
OPTICAL RING ACCESS UNIT 6
BYPASS CHANNELS
OPTICAL RING ACCESS UNIT 3
2803-6
λ4
λ3
λ2
λ1
λ0
OPTICAL RING ACCESS UNIT 5
OPTICAL RING ACCESS UNIT 4
2803-5
2803-4

FIG.31

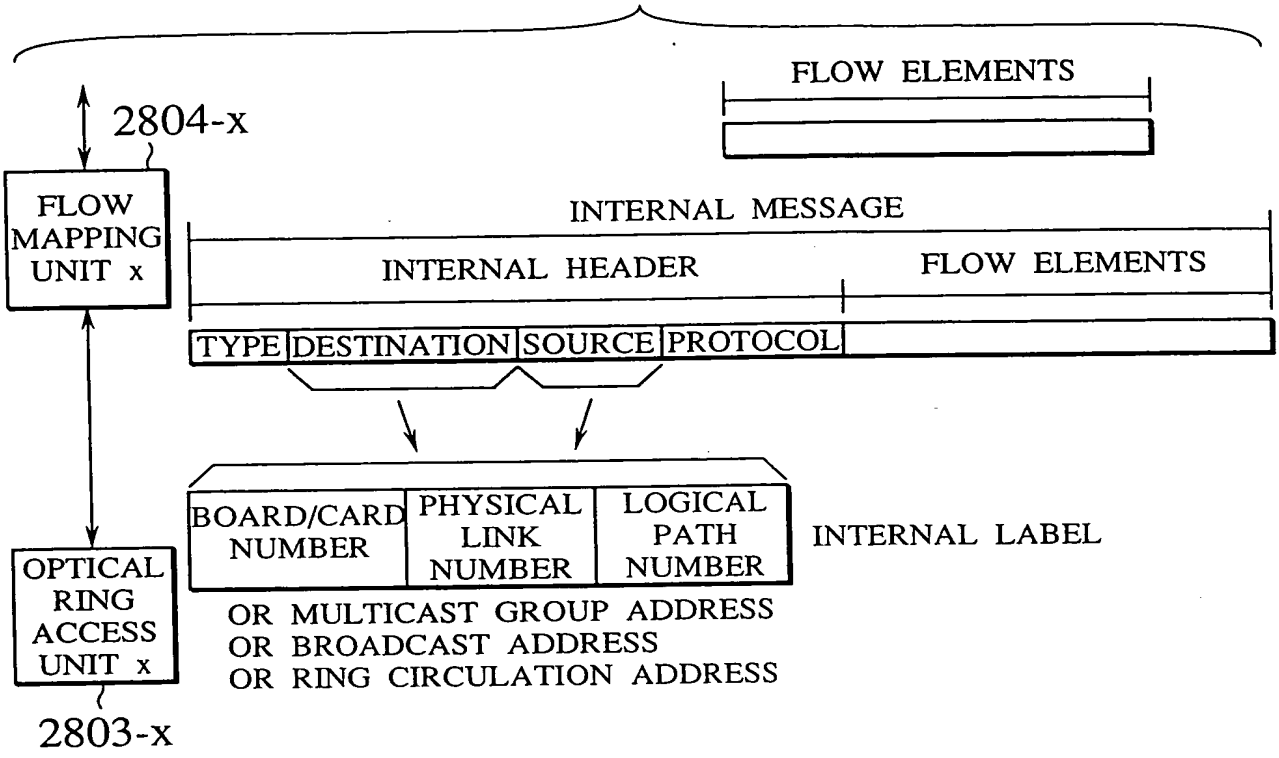

FLOW ELEMENTS
2804-x
FLOW MAPPING UNIT x
INTERNAL MESSAGE
INTERNAL HEADER
FLOW ELEMENTS
TYPE
DESTINATION
SOURCE
PROTOCOL
BOARD/CARD NUMBER
PHYSICAL LINK NUMBER
LOGICAL PATH NUMBER
INTERNAL LABEL
OR MULTICAST GROUP ADDRESS
OR BROADCAST ADDRESS
OR RING CIRCULATION ADDRESS
OPTICAL RING ACCESS UNIT x
2803-x

FIG.32

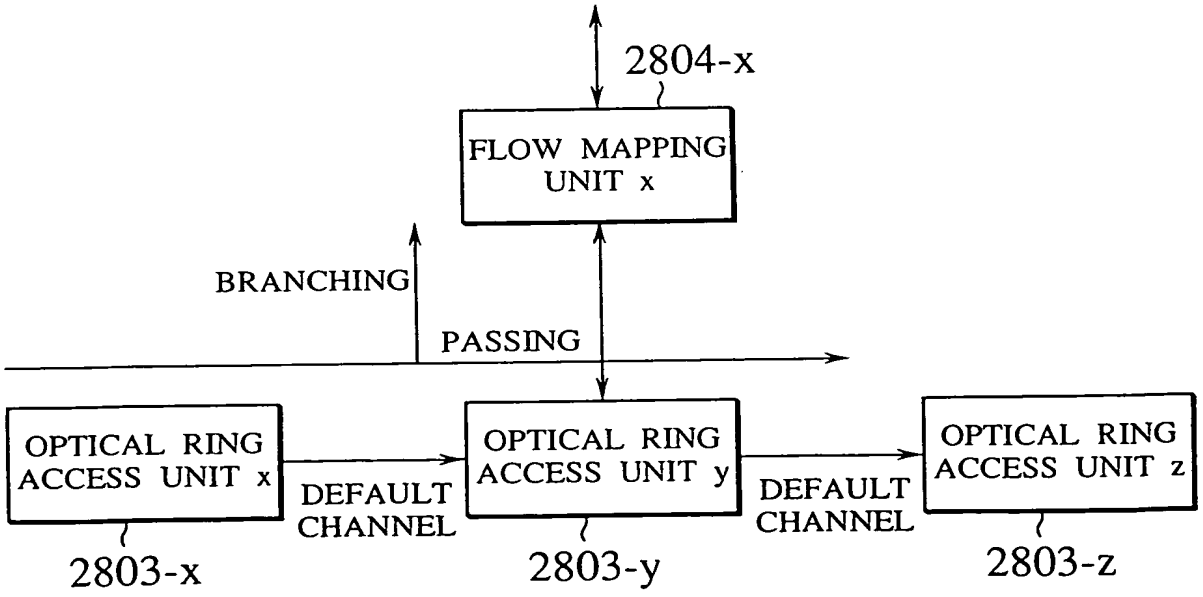

2804-x
FLOW MAPPING UNIT x
BRANCHING
PASSING
OPTICAL RING ACCESS UNIT x
DEFAULT CHANNEL
OPTICAL RING ACCESS UNIT y
DEFAULT CHANNEL
OPTICAL RING ACCESS UNIT z
2803-x
2803-y
2803-z

FIG.33

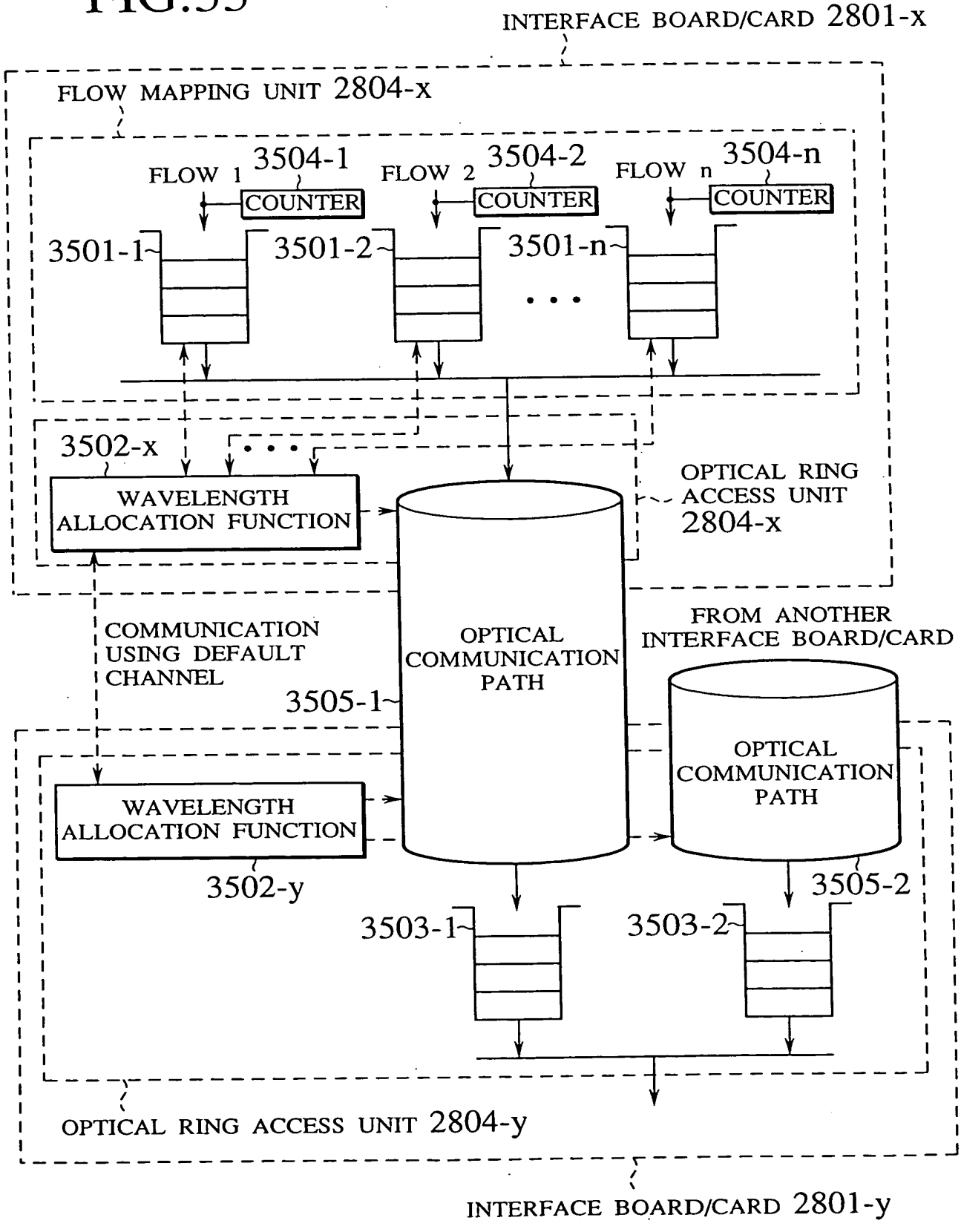

INTERFACE BOARD/CARD 2801-x
FLOW MAPPING UNIT 2804-x
FLOW 1
3504-1
COUNTER
FLOW 2
3504-2
COUNTER
FLOW n
3504-n
COUNTER
3501-1
3501-2
3501-n
3502-x
WAVELENGTH ALLOCATION FUNCTION
OPTICAL RING ACCESS UNIT 2804-x
COMMUNICATION USING DEFAULT CHANNEL
OPTICAL COMMUNICATION PATH
FROM ANOTHER INTERFACE BOARD/CARD
3505-1
OPTICAL COMMUNICATION PATH
WAVELENGTH ALLOCATION FUNCTION
3502-y
3505-2
3503-1
3503-2
OPTICAL RING ACCESS UNIT 2804-y
INTERFACE BOARD/CARD 2801-y

FIG.34A

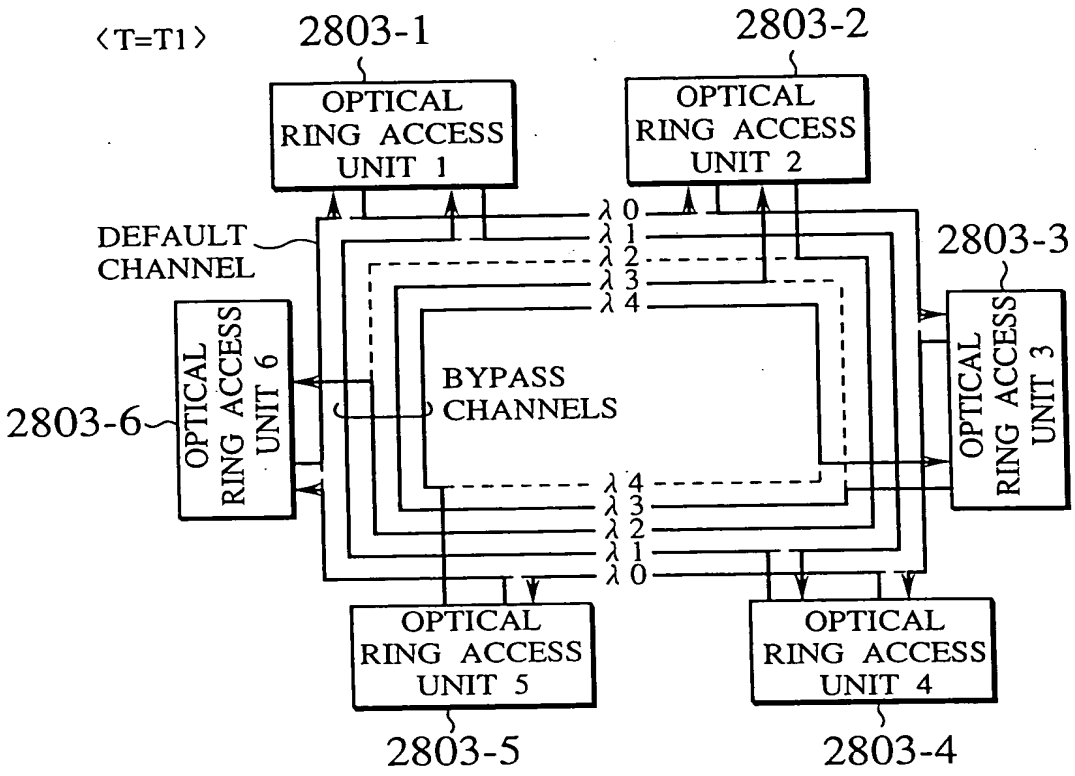


FIG.34B

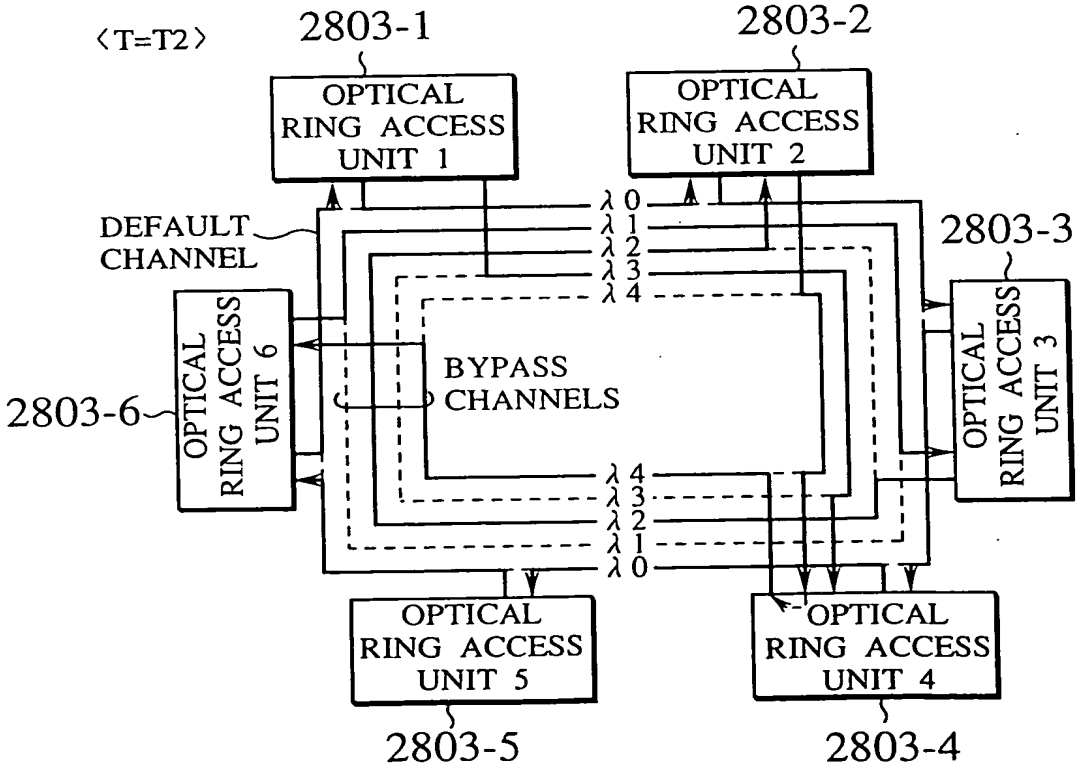


FIG.35

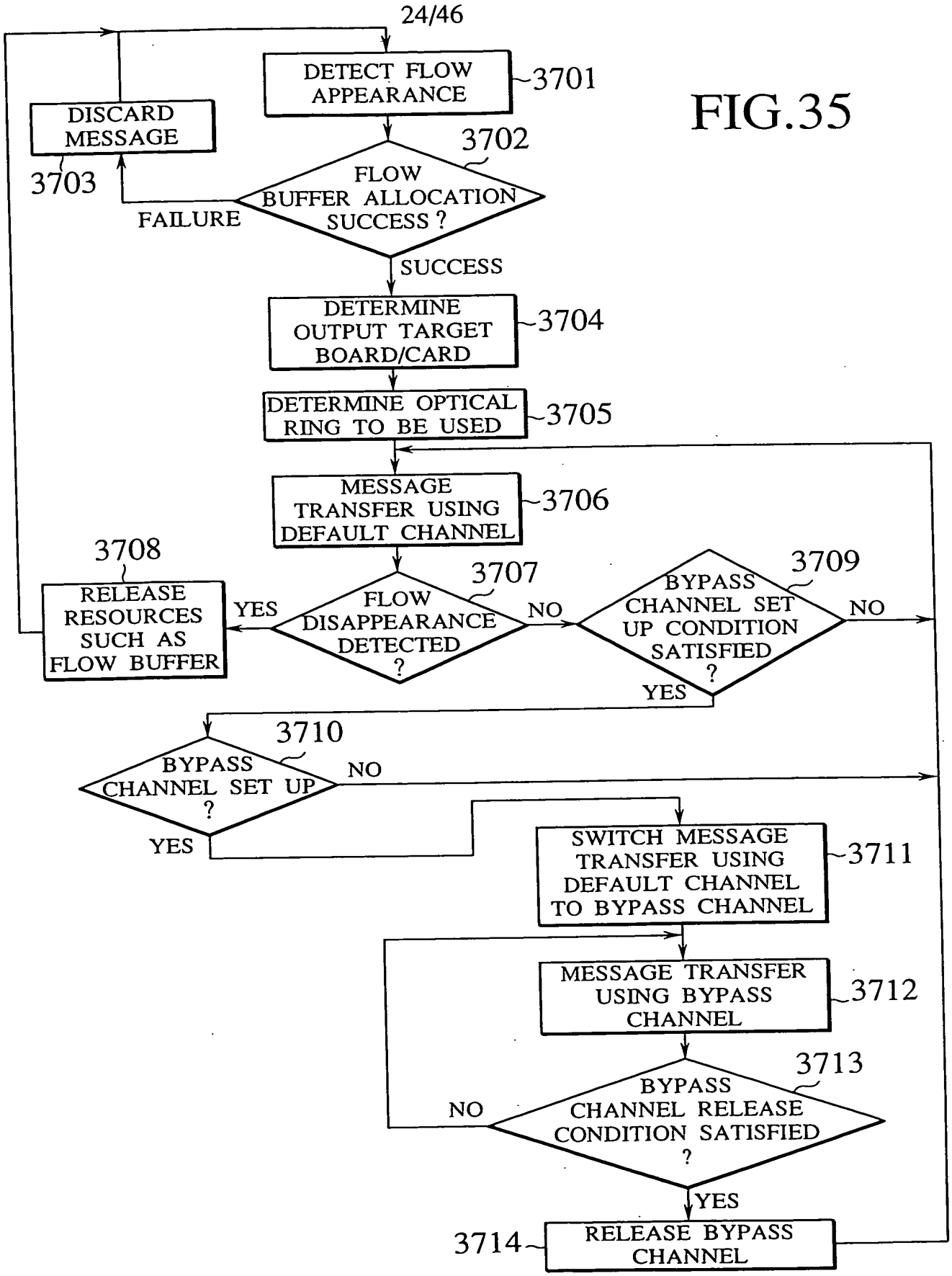
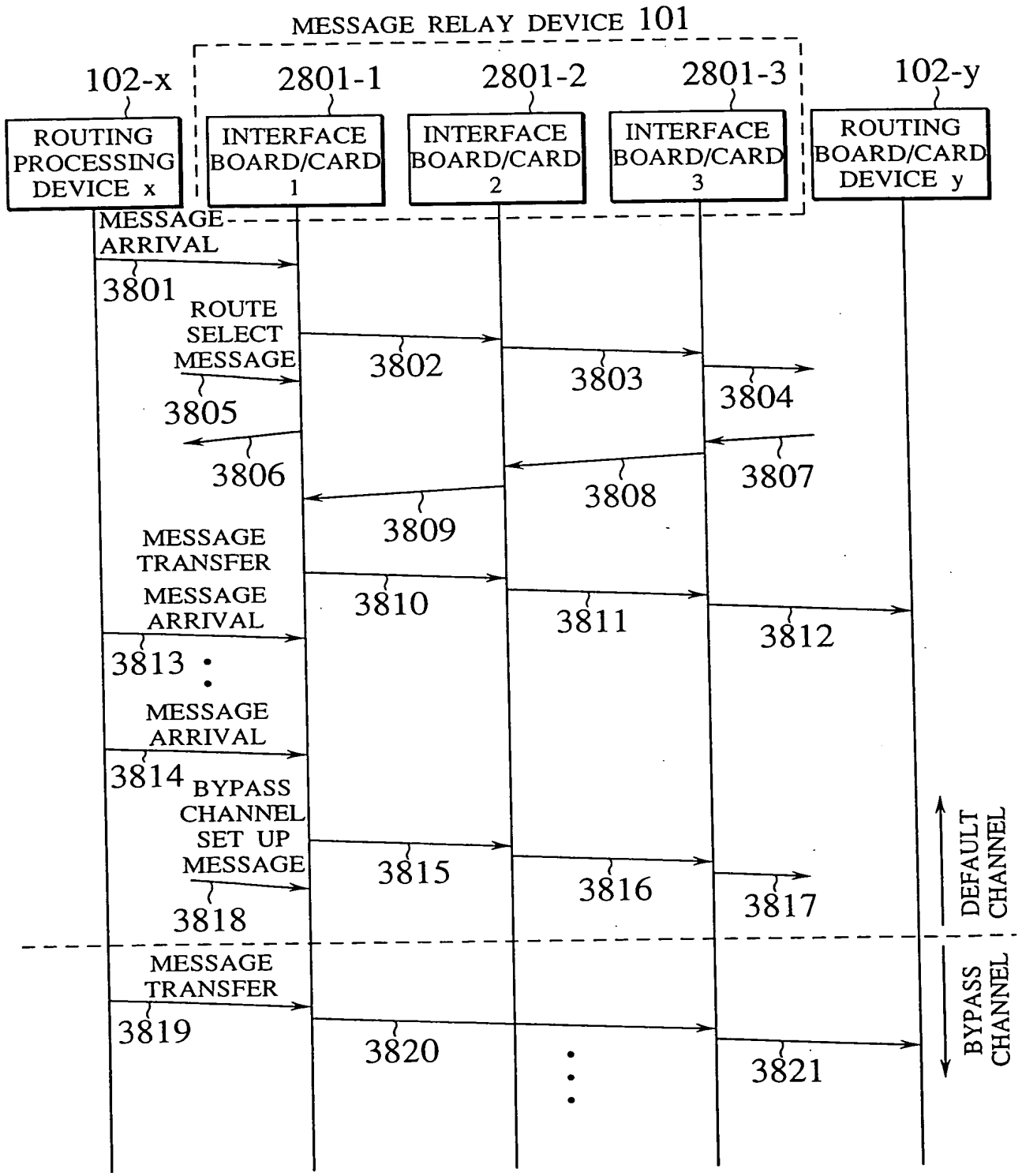

DETECT FLOW APPEARANCE
3701
FLOW BUFFER ALLOCATION SUCCESS ?
3702
FAILURE
DISCARD MESSAGE
3703
SUCCESS
DETERMINE OUTPUT TARGET BOARD/CARD
3704
DETERMINE OPTICAL RING TO BE USED
3705
MESSAGE TRANSFER USING DEFAULT CHANNEL
3706
FLOW DISAPPEARANCE DETECTED ?
3707
YES
NO
RELEASE RESOURCES SUCH AS FLOW BUFFER
3708
BYPASS CHANNEL SET UP CONDITION SATISFIED ?
3709
NO
YES
BYPASS CHANNEL SET UP ?
3710
NO
YES
SWITCH MESSAGE TRANSFER USING DEFAULT CHANNEL TO BYPASS CHANNEL
3711
MESSAGE TRANSFER USING BYPASS CHANNEL
3712
BYPASS CHANNEL RELEASE CONDITION SATISFIED ?
3713
NO
YES
RELEASE BYPASS CHANNEL
3714

FIG.36


MESSAGE RELAY DEVICE 101
102-x
2801-1
2801-2
2801-3
102-y
ROUTING PROCESSING DEVICE x
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
INTERFACE BOARD/CARD 3
ROUTING BOARD/CARD DEVICE y
MESSAGE ARRIVAL
3801
ROUTE SELECT MESSAGE
3802
3803
3804
3805
3806
3807
3808
3809
MESSAGE TRANSFER
3810
MESSAGE ARRIVAL
3811
3812
3813
MESSAGE ARRIVAL
3814
BYPASS CHANNEL SET UP MESSAGE
3815
3816
3817
3818
DEFAULT CHANNEL
MESSAGE TRANSFER
3819
3820
3821
BYPASS CHANNEL

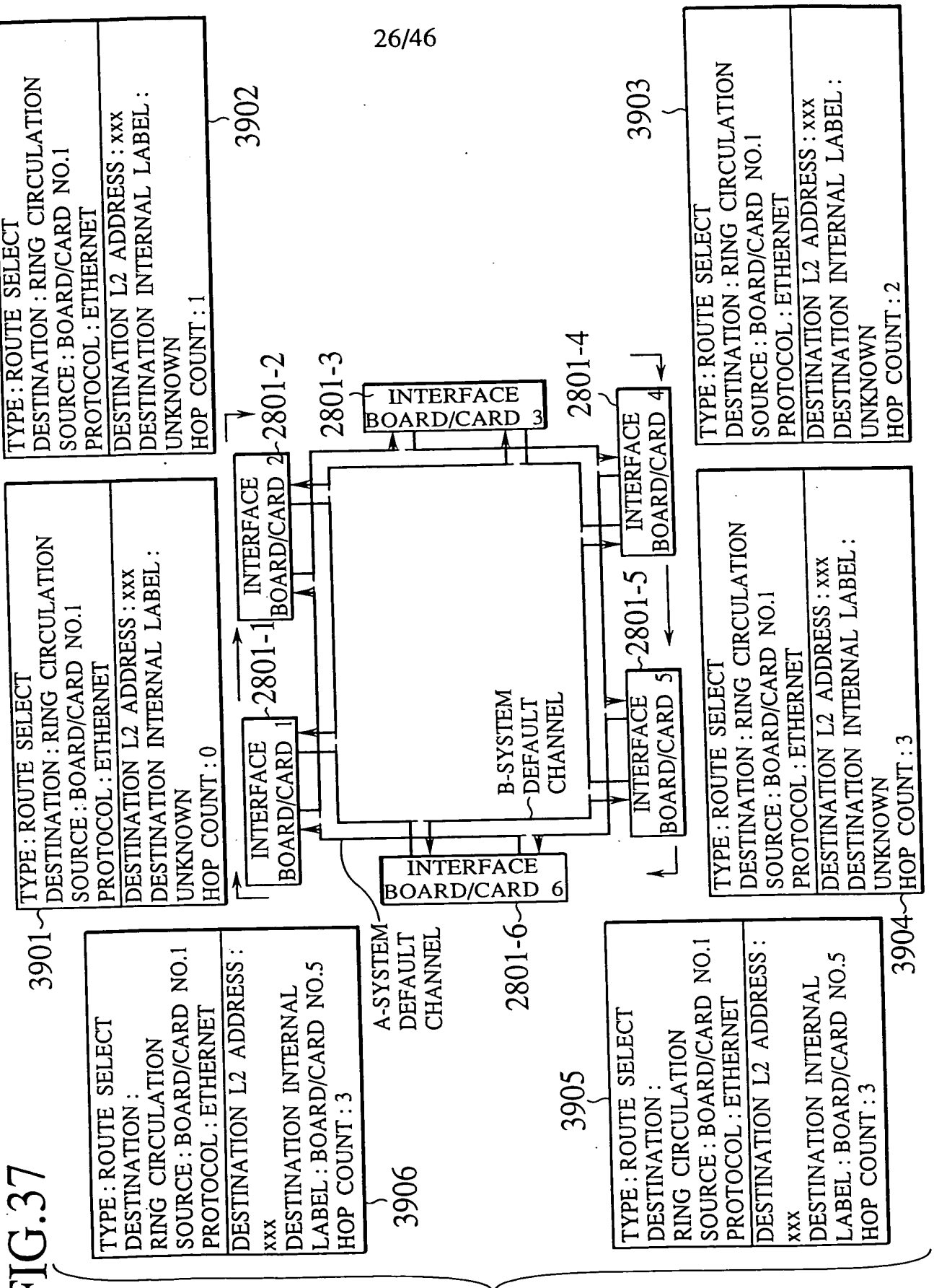

TYPE : ROUTE SELECT
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION L2 ADDRESS : xxx
DESTINATION INTERNAL LABEL : UNKNOWN
HOP COUNT : 1
3902
TYPE : ROUTE SELECT
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION L2 ADDRESS : xxx
DESTINATION INTERNAL LABEL : UNKNOWN
HOP COUNT : 2
3903
TYPE : ROUTE SELECT
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION L2 ADDRESS : xxx
DESTINATION INTERNAL LABEL : UNKNOWN
HOP COUNT : 0
3901
TYPE : ROUTE SELECT
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION L2 ADDRESS : xxx
DESTINATION INTERNAL LABEL : UNKNOWN
HOP COUNT : 3
3904
TYPE : ROUTE SELECT
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION L2 ADDRESS : xxx
DESTINATION INTERNAL LABEL : UNKNOWN
HOP COUNT : 3
3905
3906
INTERFACE BOARD/CARD 1
2801-1
INTERFACE BOARD/CARD 2
2801-2
INTERFACE BOARD/CARD 3
2801-3
INTERFACE BOARD/CARD 4
2801-4
INTERFACE BOARD/CARD 5
2801-5
INTERFACE BOARD/CARD 6
2801-6
B-SYSTEM DEFAULT CHANNEL
A-SYSTEM DEFAULT CHANNEL

FIG.37

FIG.38

INTERNAL ROUTE INFORMATION HOLDING TABLE 4101

INTERNAL LABEL	PRIMARY ROUTE	SELECTED ROUTE	SELECTED CHANNEL
CLOCKWISE	A-SYSTEM	BYPASS CHANNEL	
NOT SEARCHED	-----	-----	

FIG.39

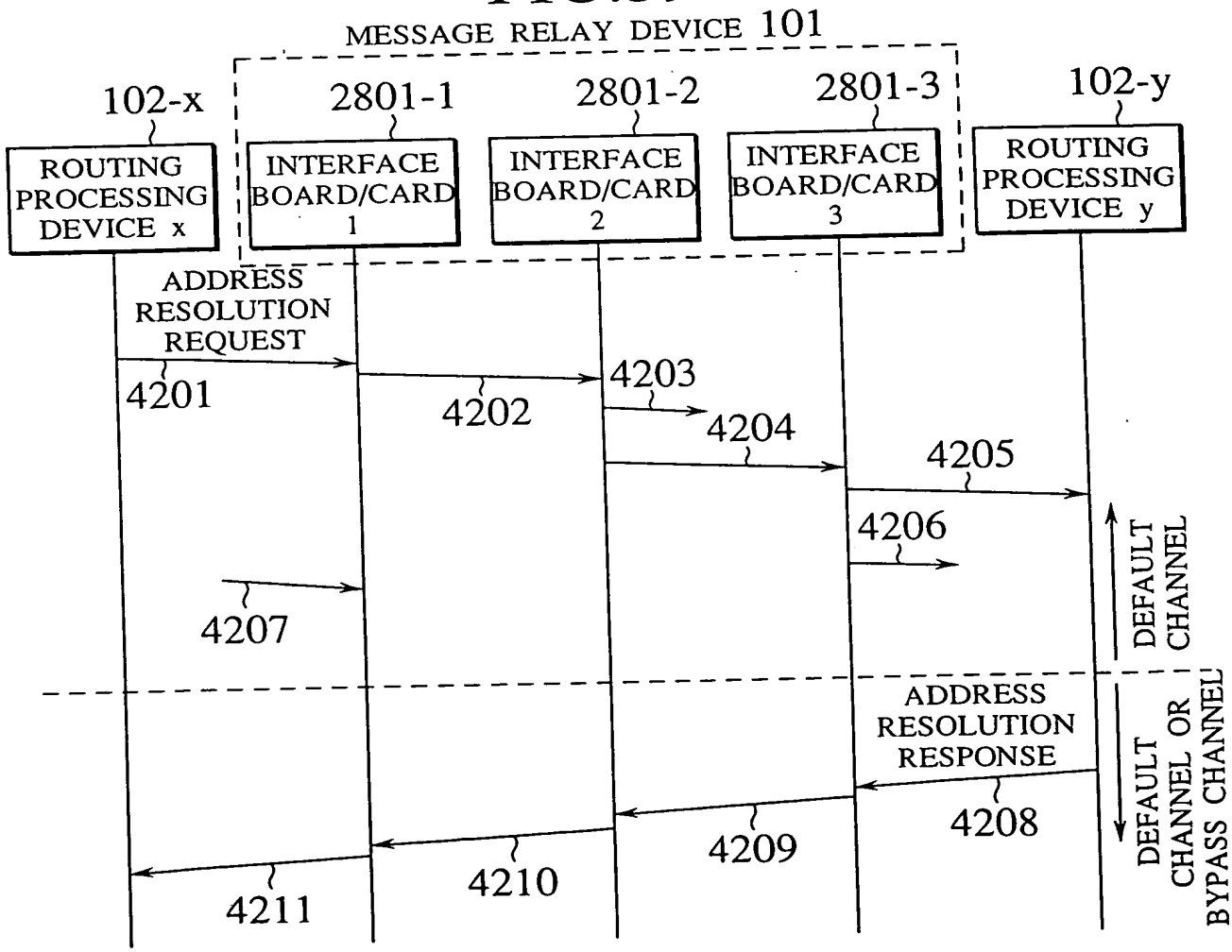


FIG.40

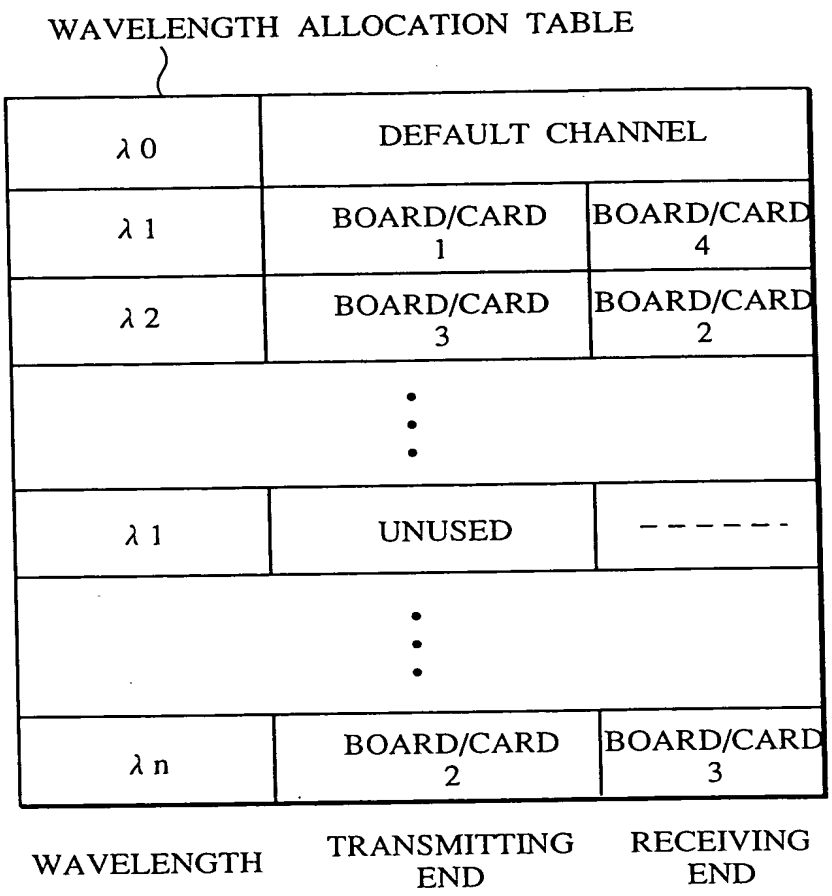

WAVELENGTH ALLOCATION TABLE
λ 0
DEFAULT CHANNEL
λ 1
BOARD/CARD 1
BOARD/CARD 4
λ 2
BOARD/CARD 3
BOARD/CARD 2
λ 1
UNUSED
λ n
BOARD/CARD 2
BOARD/CARD 3
WAVELENGTH
TRANSMITTING END
RECEIVING END

FIG.41

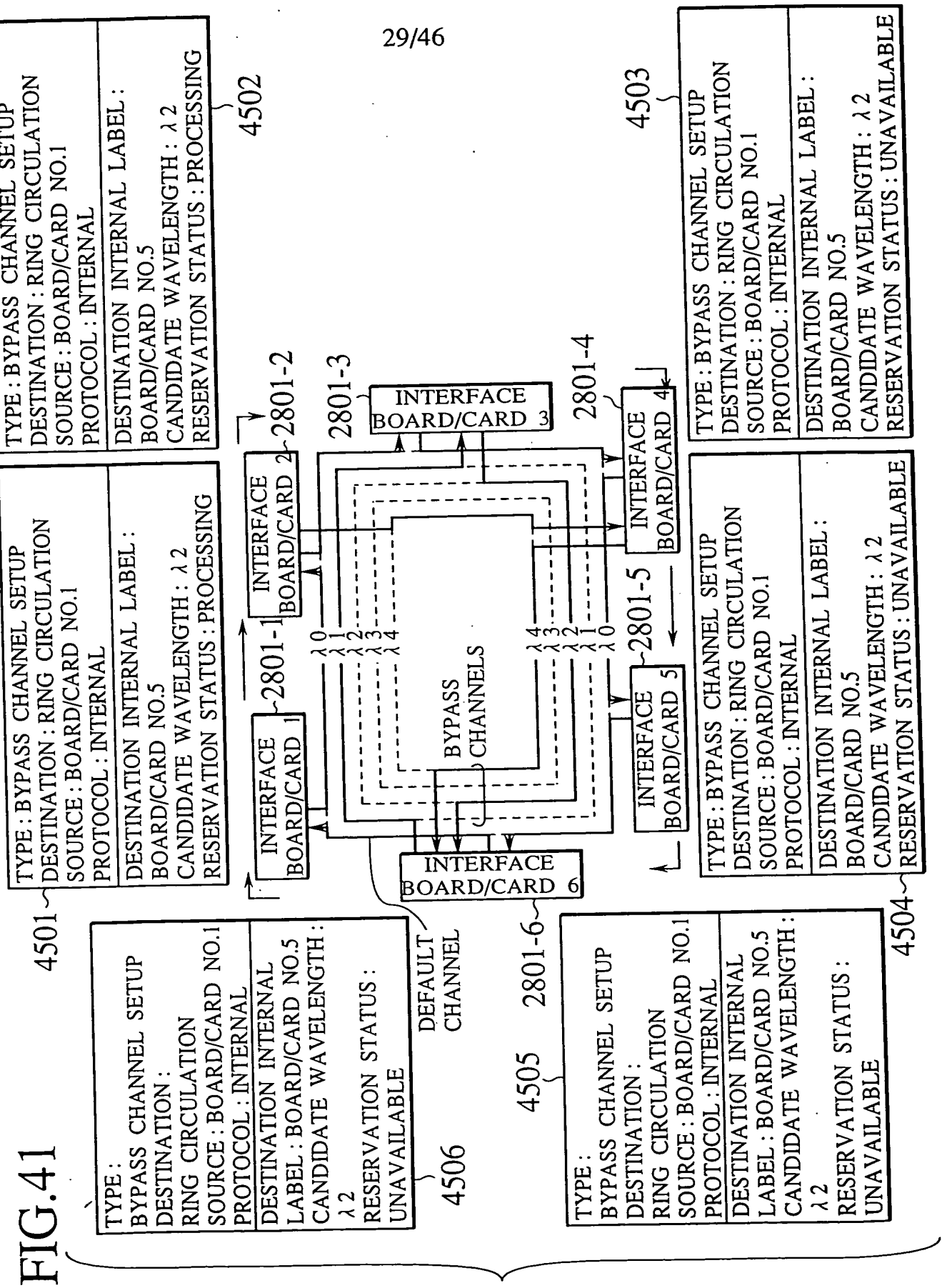

4501
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : PROCESSING
4502
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : PROCESSING
4503
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : UNAVAILABLE
4504
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : UNAVAILABLE
4505
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : UNAVAILABLE
4506
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : UNAVAILABLE
DEFAULT CHANNEL
2801-1
2801-2
2801-3
2801-4
2801-5
2801-6
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
INTERFACE BOARD/CARD 3
INTERFACE BOARD/CARD 4
INTERFACE BOARD/CARD 5
INTERFACE BOARD/CARD 6
BYPASS CHANNELS
λ0
λ1
λ2
λ3
λ4

FIG.42

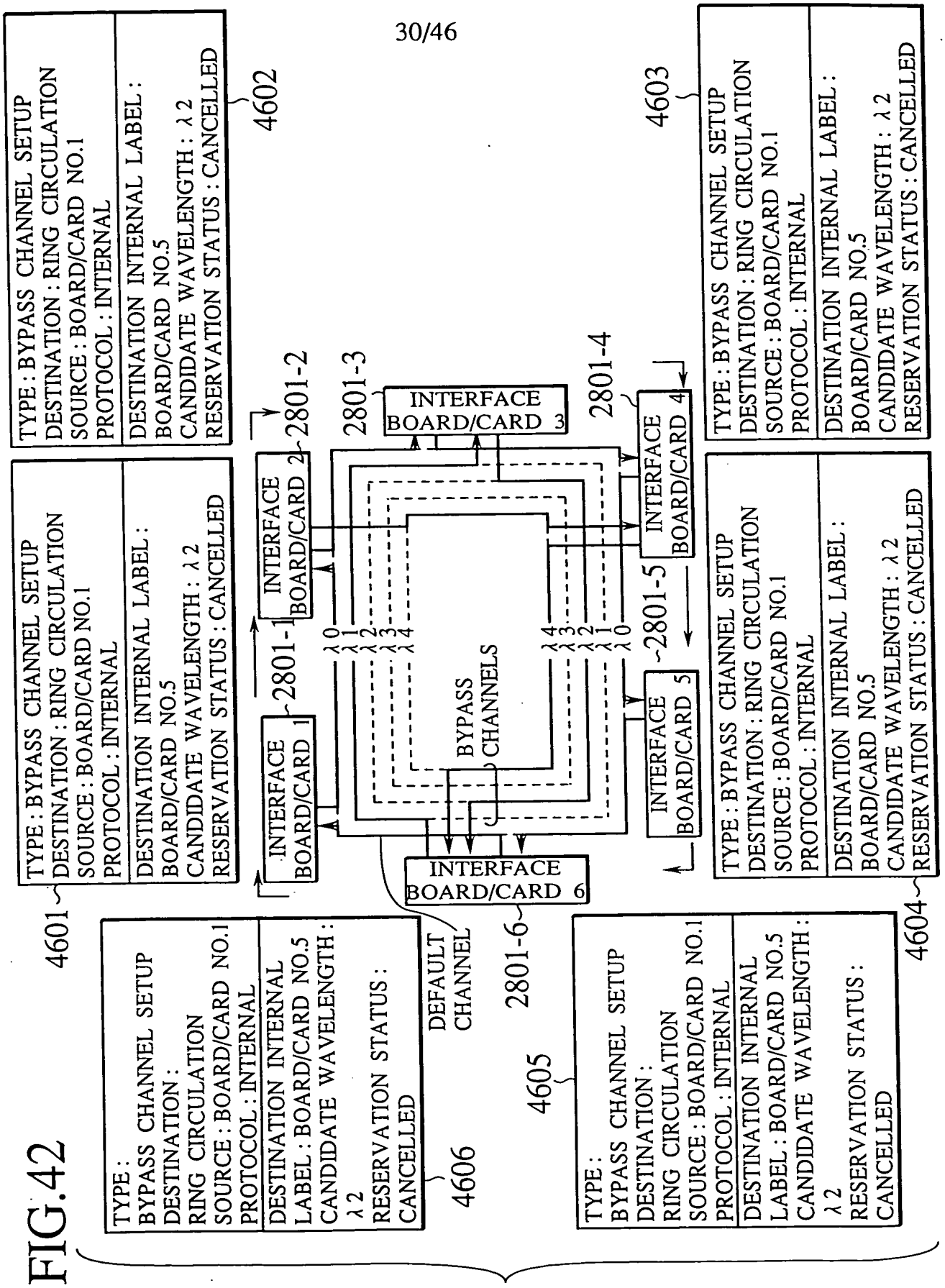

4601
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
4602
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
4603
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
4604
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
4605
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
4606
TYPE : BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ2
RESERVATION STATUS : CANCELLED
DEFAULT CHANNEL
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
INTERFACE BOARD/CARD 3
INTERFACE BOARD/CARD 4
INTERFACE BOARD/CARD 5
INTERFACE BOARD/CARD 6
2801-1
2801-2
2801-3
2801-4
2801-5
2801-6
BYPASS CHANNELS
λ0
λ1
λ2
λ3
λ4

FIG.43

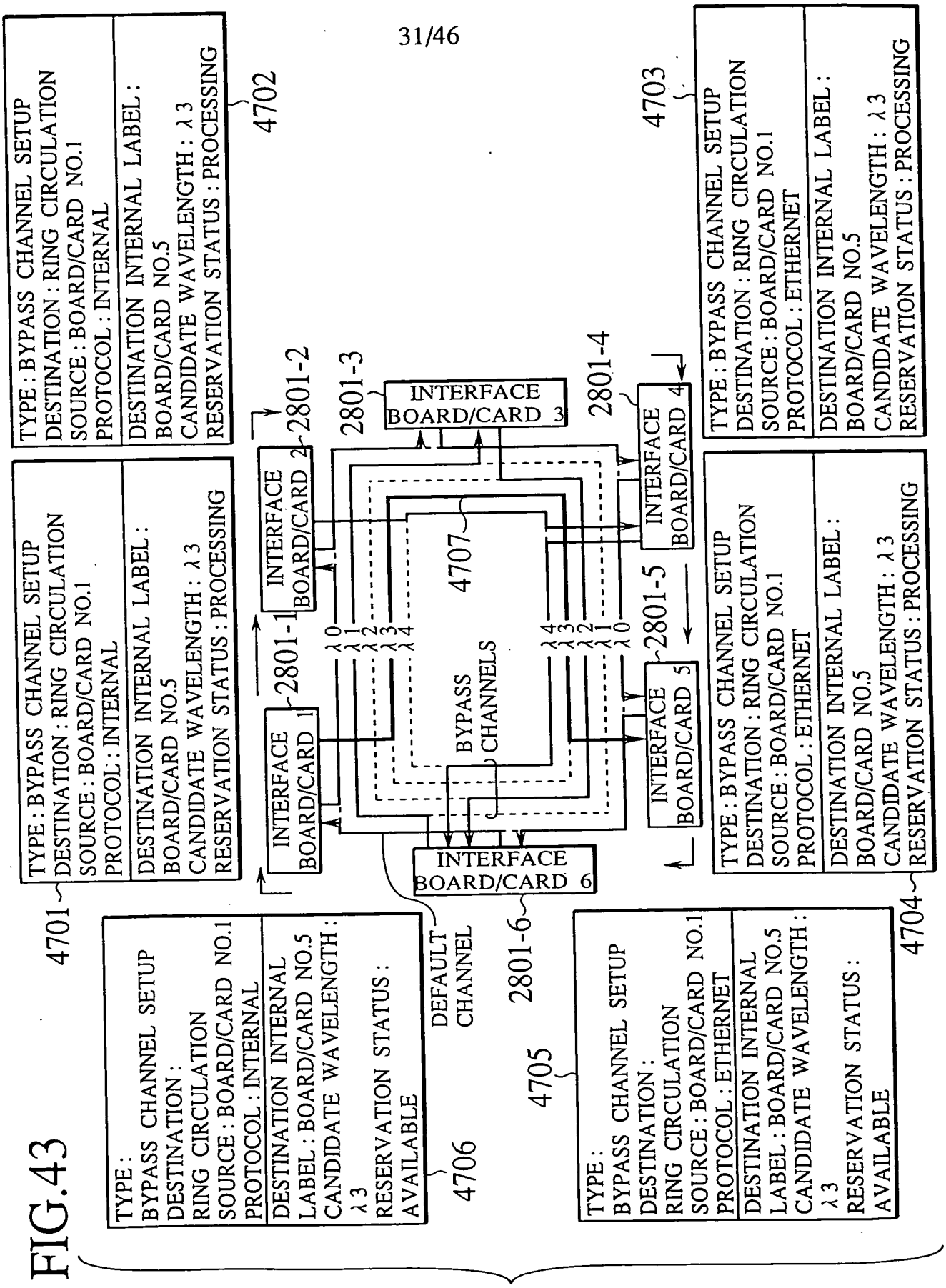

4701
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL :
BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ3
RESERVATION STATUS : PROCESSING
4702
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL :
BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ3
RESERVATION STATUS : PROCESSING
4703
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL LABEL :
BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ3
RESERVATION STATUS : PROCESSING
4704
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL LABEL :
BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ3
RESERVATION STATUS : PROCESSING
4705
TYPE :
BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL
LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH :
λ3
RESERVATION STATUS :
AVAILABLE
4706
TYPE :
BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL
LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH :
λ3
RESERVATION STATUS :
AVAILABLE
DEFAULT CHANNEL
2801-1
INTERFACE BOARD/CARD 1
2801-2
INTERFACE BOARD/CARD 2
2801-3
INTERFACE BOARD/CARD 3
2801-4
INTERFACE BOARD/CARD 4
2801-5
INTERFACE BOARD/CARD 5
2801-6
INTERFACE BOARD/CARD 6
4707
BYPASS CHANNELS
λ0
λ1
λ2
λ3
λ4

FIG.44

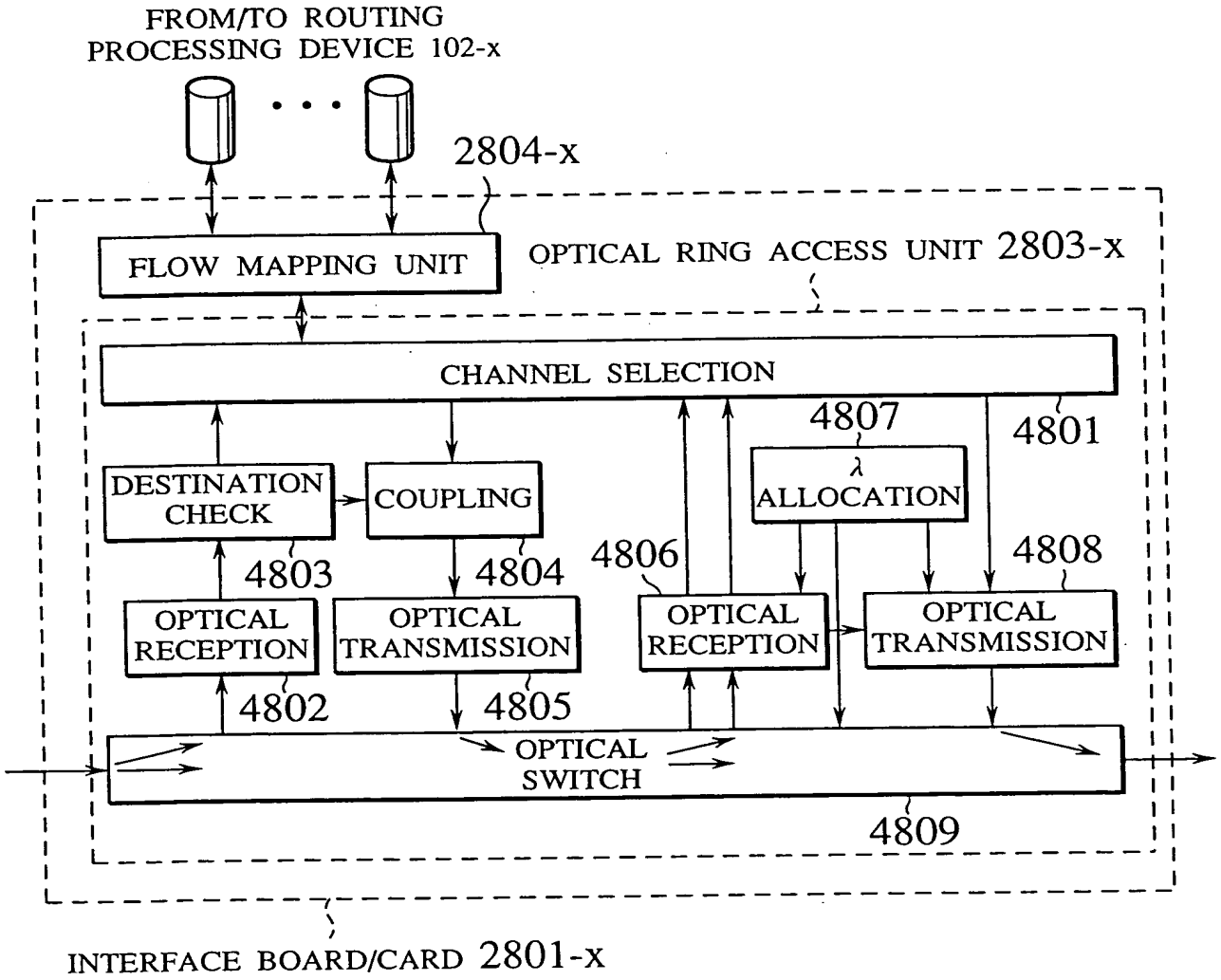

FROM/TO ROUTING PROCESSING DEVICE 102-x
2804-x
FLOW MAPPING UNIT
OPTICAL RING ACCESS UNIT 2803-x
CHANNEL SELECTION
4807
4801
DESTINATION CHECK
COUPLING
λ ALLOCATION
4806
4808
4803
4804
OPTICAL RECEPTION
OPTICAL TRANSMISSION
OPTICAL RECEPTION
OPTICAL TRANSMISSION
4802
4805
OPTICAL SWITCH
4809
INTERFACE BOARD/CARD 2801-x

FIG.45

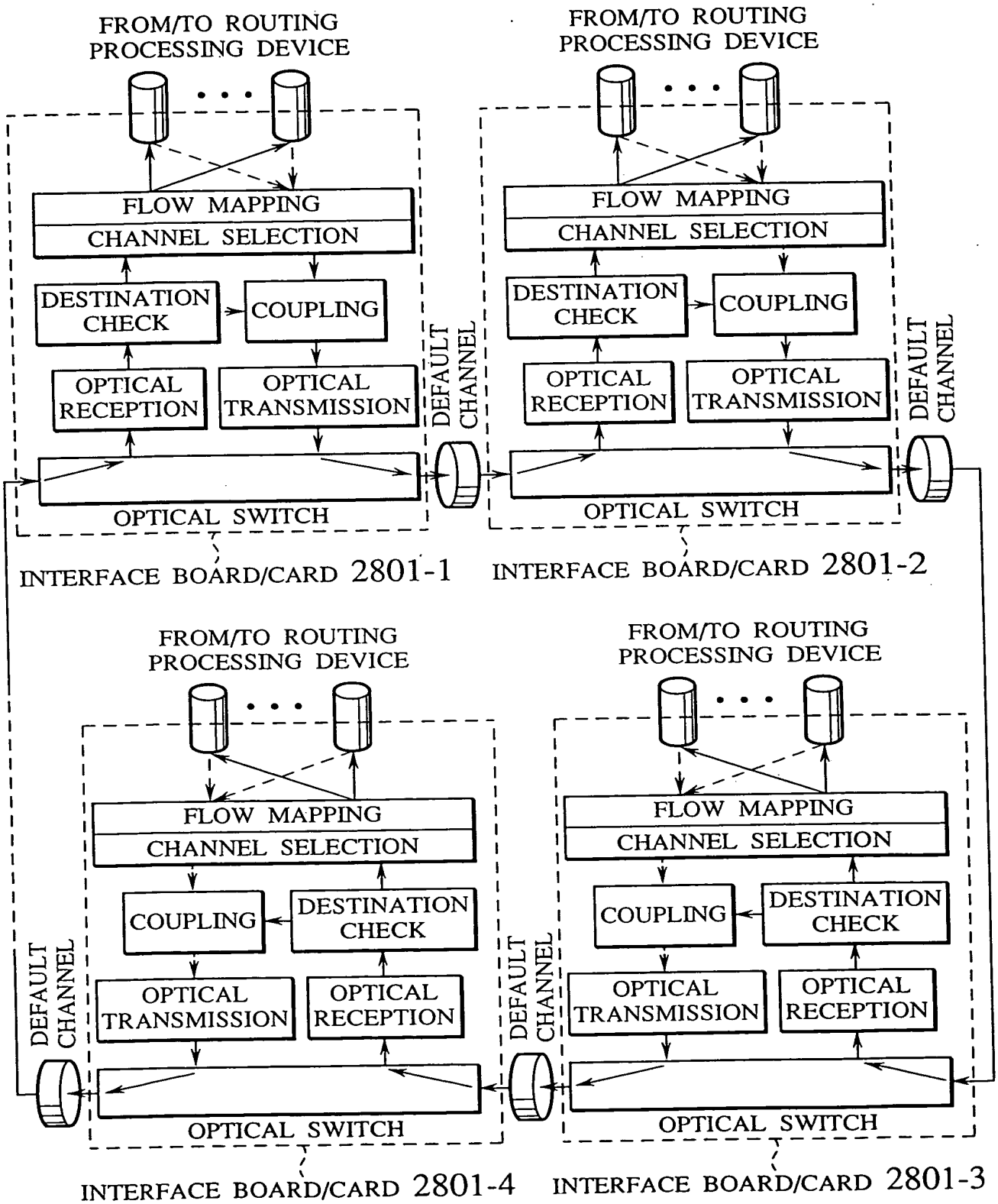

FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-1
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-2
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-4
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-3

FIG.46

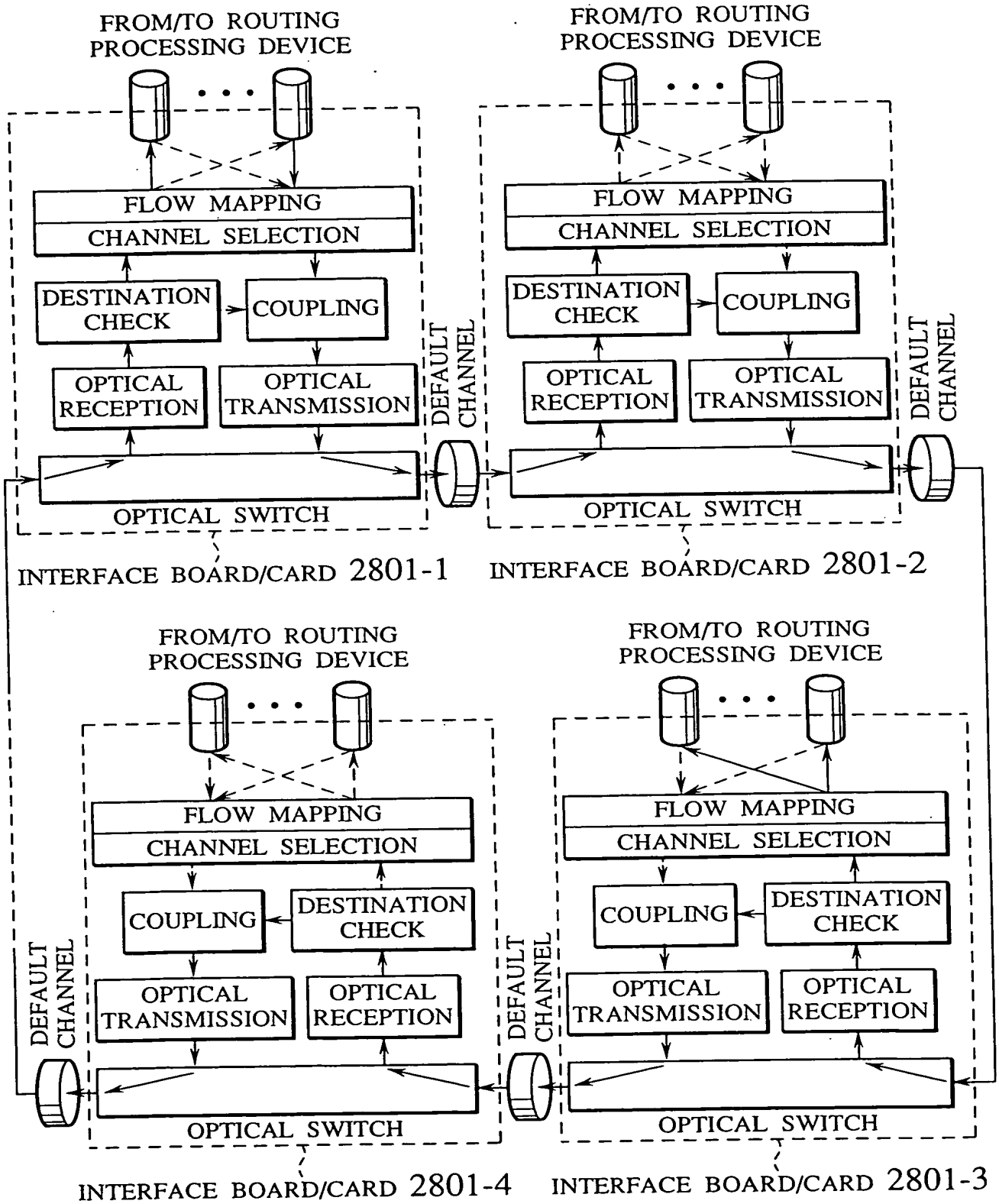

FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-1
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-2
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-4
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-3

FIG.47

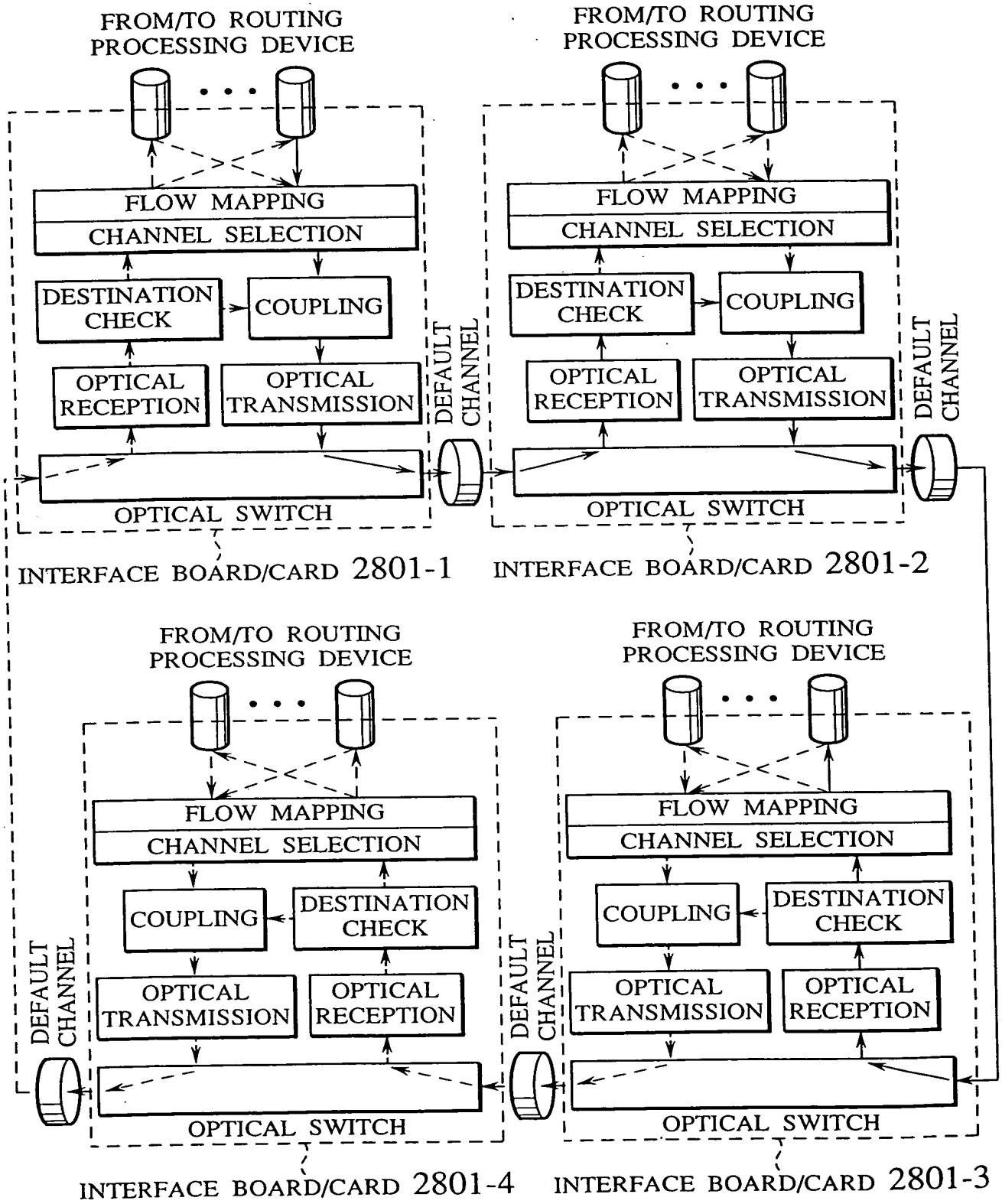

FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-1
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
DESTINATION CHECK
COUPLING
OPTICAL RECEPTION
OPTICAL TRANSMISSION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-2
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-4
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
COUPLING
DESTINATION CHECK
OPTICAL TRANSMISSION
OPTICAL RECEPTION
DEFAULT CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-3

FIG.48

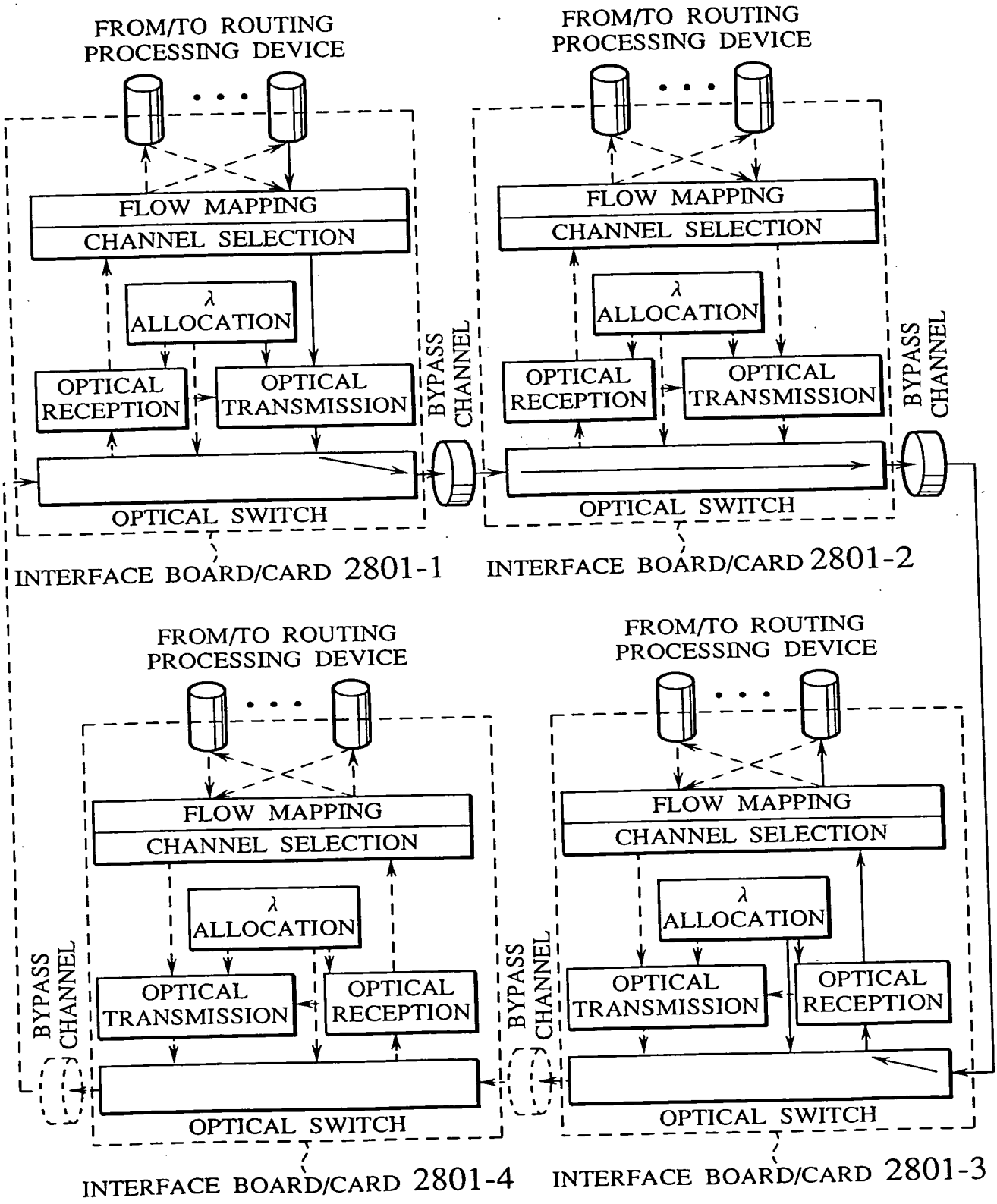

FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL RECEPTION
OPTICAL TRANSMISSION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-1
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL RECEPTION
OPTICAL TRANSMISSION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-2
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL TRANSMISSION
OPTICAL RECEPTION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-4
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL TRANSMISSION
OPTICAL RECEPTION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-3

FIG.49

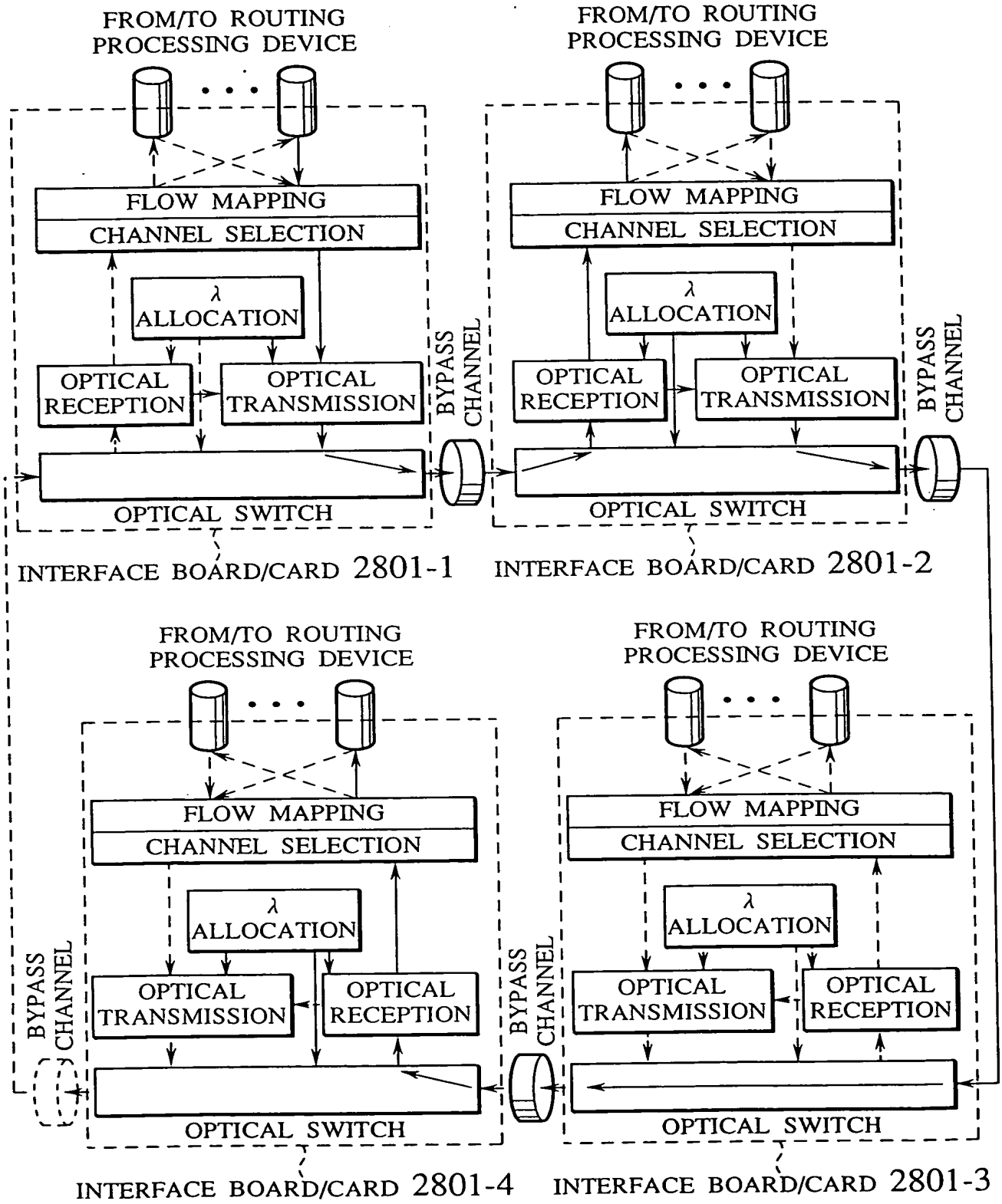

FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL RECEPTION
OPTICAL TRANSMISSION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-1
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL RECEPTION
OPTICAL TRANSMISSION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-2
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL TRANSMISSION
OPTICAL RECEPTION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-4
FROM/TO ROUTING PROCESSING DEVICE
FLOW MAPPING
CHANNEL SELECTION
λ ALLOCATION
OPTICAL TRANSMISSION
OPTICAL RECEPTION
BYPASS CHANNEL
OPTICAL SWITCH
INTERFACE BOARD/CARD 2801-3

FIG.50

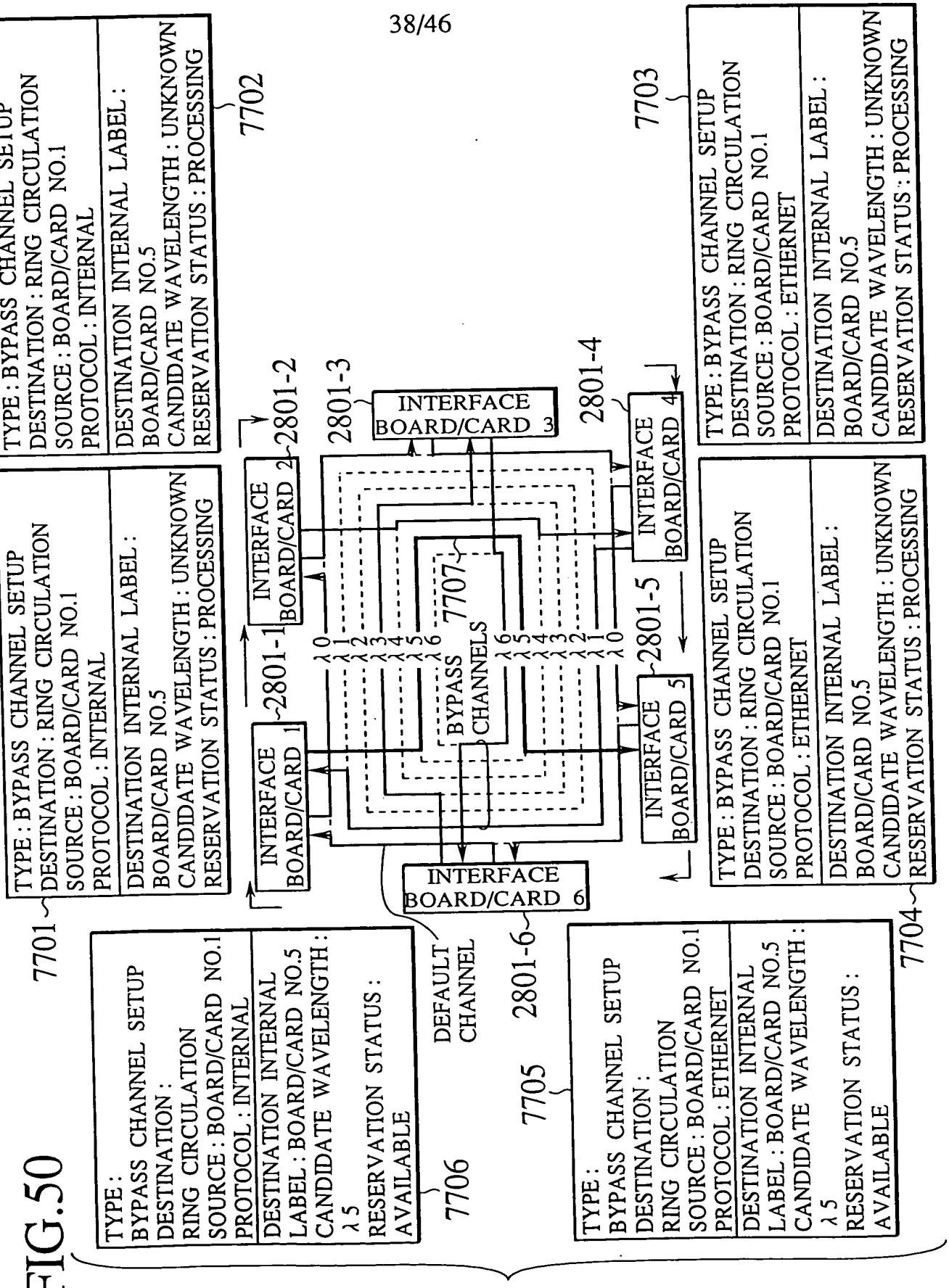

7701
TYPE: BYPASS CHANNEL SETUP
DESTINATION: RING CIRCULATION
SOURCE: BOARD/CARD NO.1
PROTOCOL: INTERNAL
DESTINATION INTERNAL LABEL: BOARD/CARD NO.5
CANDIDATE WAVELENGTH: UNKNOWN
RESERVATION STATUS: PROCESSING
7702
TYPE: BYPASS CHANNEL SETUP
DESTINATION: RING CIRCULATION
SOURCE: BOARD/CARD NO.1
PROTOCOL: INTERNAL
DESTINATION INTERNAL LABEL: BOARD/CARD NO.5
CANDIDATE WAVELENGTH: UNKNOWN
RESERVATION STATUS: PROCESSING
7703
TYPE: BYPASS CHANNEL SETUP
DESTINATION: RING CIRCULATION
SOURCE: BOARD/CARD NO.1
PROTOCOL: ETHERNET
DESTINATION INTERNAL LABEL: BOARD/CARD NO.5
CANDIDATE WAVELENGTH: UNKNOWN
RESERVATION STATUS: PROCESSING
7704
TYPE: BYPASS CHANNEL SETUP
DESTINATION: RING CIRCULATION
SOURCE: BOARD/CARD NO.1
PROTOCOL: ETHERNET
DESTINATION INTERNAL LABEL: BOARD/CARD NO.5
CANDIDATE WAVELENGTH: λ5
RESERVATION STATUS: AVAILABLE
7705
TYPE: BYPASS CHANNEL SETUP
DESTINATION: RING CIRCULATION
SOURCE: BOARD/CARD NO.1
PROTOCOL: ETHERNET
DESTINATION INTERNAL LABEL: BOARD/CARD NO.5
CANDIDATE WAVELENGTH: λ5
RESERVATION STATUS: AVAILABLE
7706
DEFAULT CHANNEL
7707
BYPASS CHANNELS
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
INTERFACE BOARD/CARD 3
INTERFACE BOARD/CARD 4
INTERFACE BOARD/CARD 5
INTERFACE BOARD/CARD 6
2801-1
2801-2
2801-3
2801-4
2801-5
2801-6
λ0 λ1 λ2 λ3 λ4 λ5 λ6

FIG.51

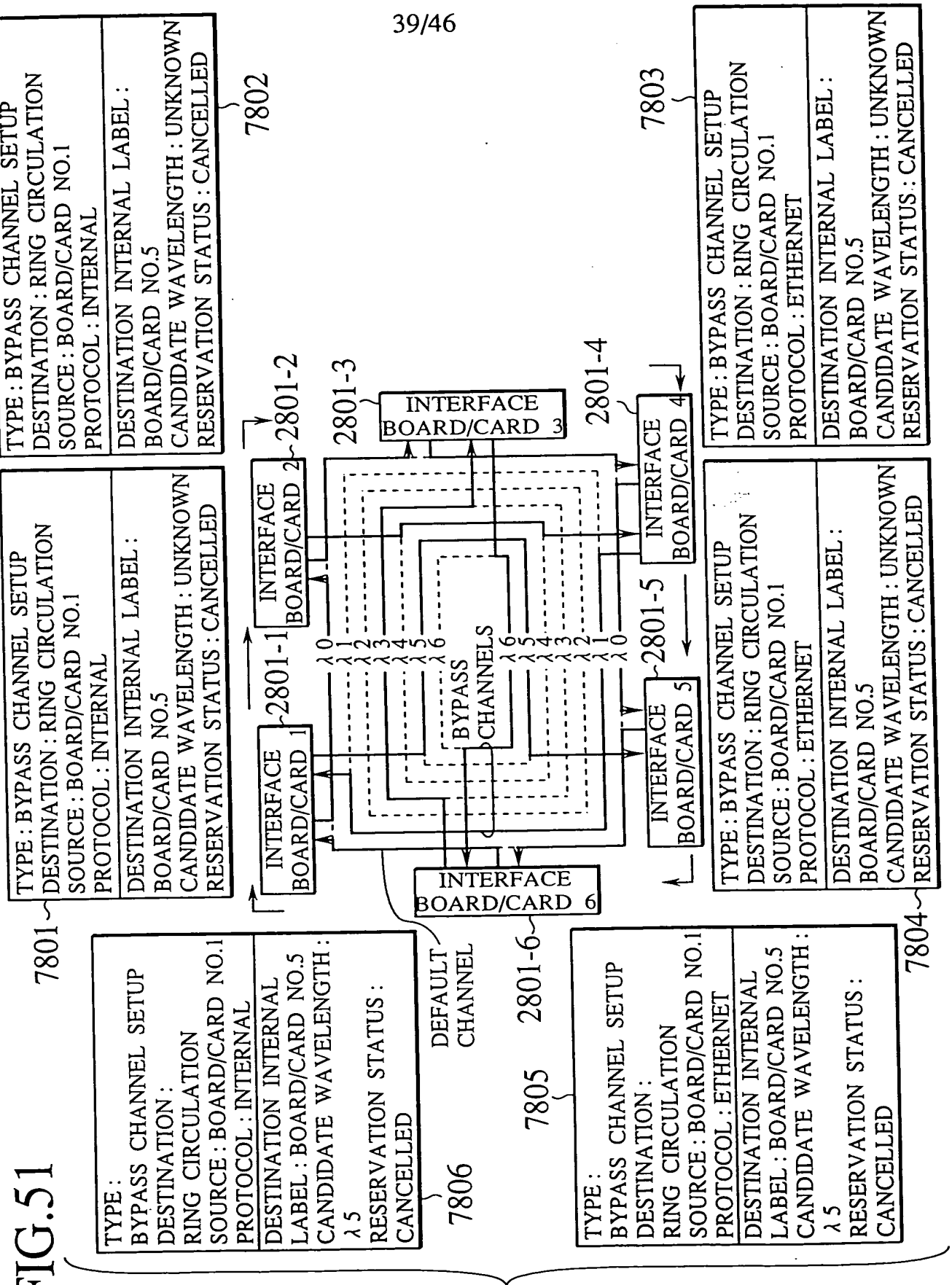

7801
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : UNKNOWN
RESERVATION STATUS : CANCELLED
7802
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : UNKNOWN
RESERVATION STATUS : CANCELLED
7803
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : UNKNOWN
RESERVATION STATUS : CANCELLED
7804
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : UNKNOWN
RESERVATION STATUS : CANCELLED
7805
TYPE : BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : ETHERNET
DESTINATION INTERNAL LABEL : BOARD/CARD NO.5
CANDIDATE WAVELENGTH : λ5
RESERVATION STATUS : CANCELLED
7806
INTERFACE BOARD/CARD 1
2801-1
INTERFACE BOARD/CARD 2
2801-2
INTERFACE BOARD/CARD 3
2801-3
INTERFACE BOARD/CARD 4
2801-4
INTERFACE BOARD/CARD 5
2801-5
INTERFACE BOARD/CARD 6
2801-6
λ0 λ1 λ2 λ3 λ4 λ5 λ6
BYPASS CHANNELS
DEFAULT CHANNEL

FIG.52

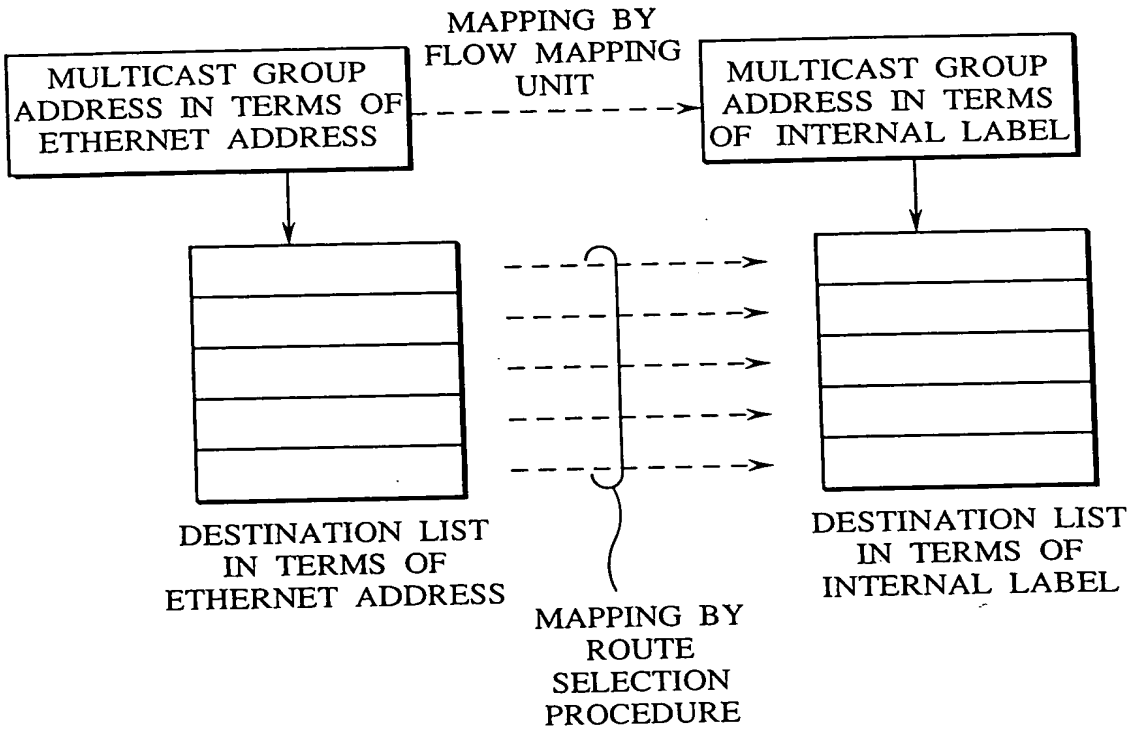

MULTICAST GROUP ADDRESS IN TERMS OF ETHERNET ADDRESS
MAPPING BY FLOW MAPPING UNIT
MULTICAST GROUP ADDRESS IN TERMS OF INTERNAL LABEL
DESTINATION LIST IN TERMS OF ETHERNET ADDRESS
MAPPING BY ROUTE SELECTION PROCEDURE
DESTINATION LIST IN TERMS OF INTERNAL LABEL

FIG.53

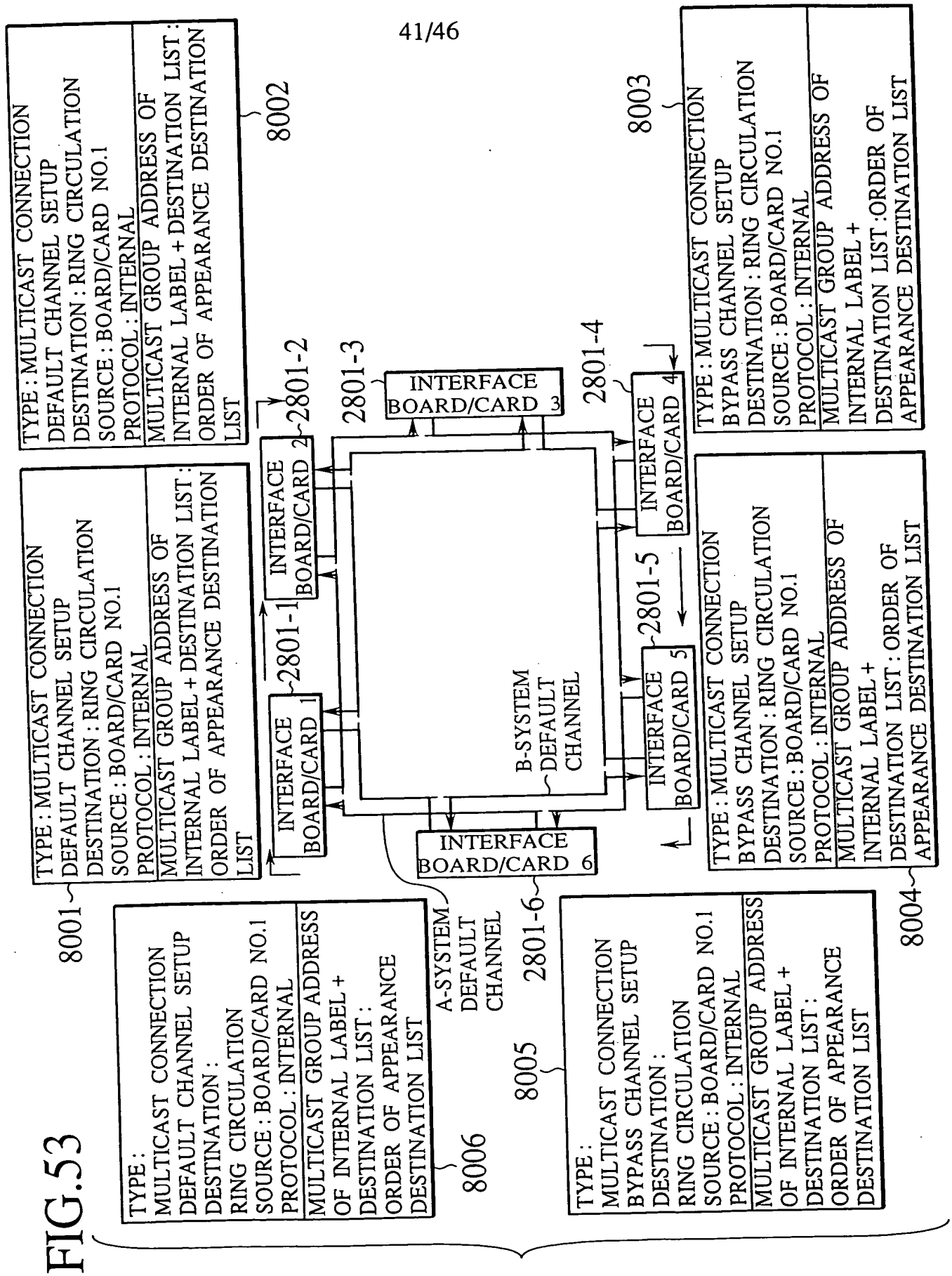

8001
TYPE : MULTICAST CONNECTION
DEFAULT CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST : ORDER OF APPEARANCE DESTINATION LIST
8002
TYPE : MULTICAST CONNECTION
DEFAULT CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST : ORDER OF APPEARANCE DESTINATION LIST
8003
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST :ORDER OF APPEARANCE DESTINATION LIST
8004
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST : ORDER OF APPEARANCE DESTINATION LIST
8005
TYPE :
MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST : ORDER OF APPEARANCE DESTINATION LIST
8006
TYPE :
MULTICAST CONNECTION
DEFAULT CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL + DESTINATION LIST : ORDER OF APPEARANCE DESTINATION LIST
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
INTERFACE BOARD/CARD 3
INTERFACE BOARD/CARD 4
INTERFACE BOARD/CARD 5
INTERFACE BOARD/CARD 6
2801-1
2801-2
2801-3
2801-4
2801-5
2801-6
B-SYSTEM DEFAULT CHANNEL
A-SYSTEM DEFAULT CHANNEL

FIG.54

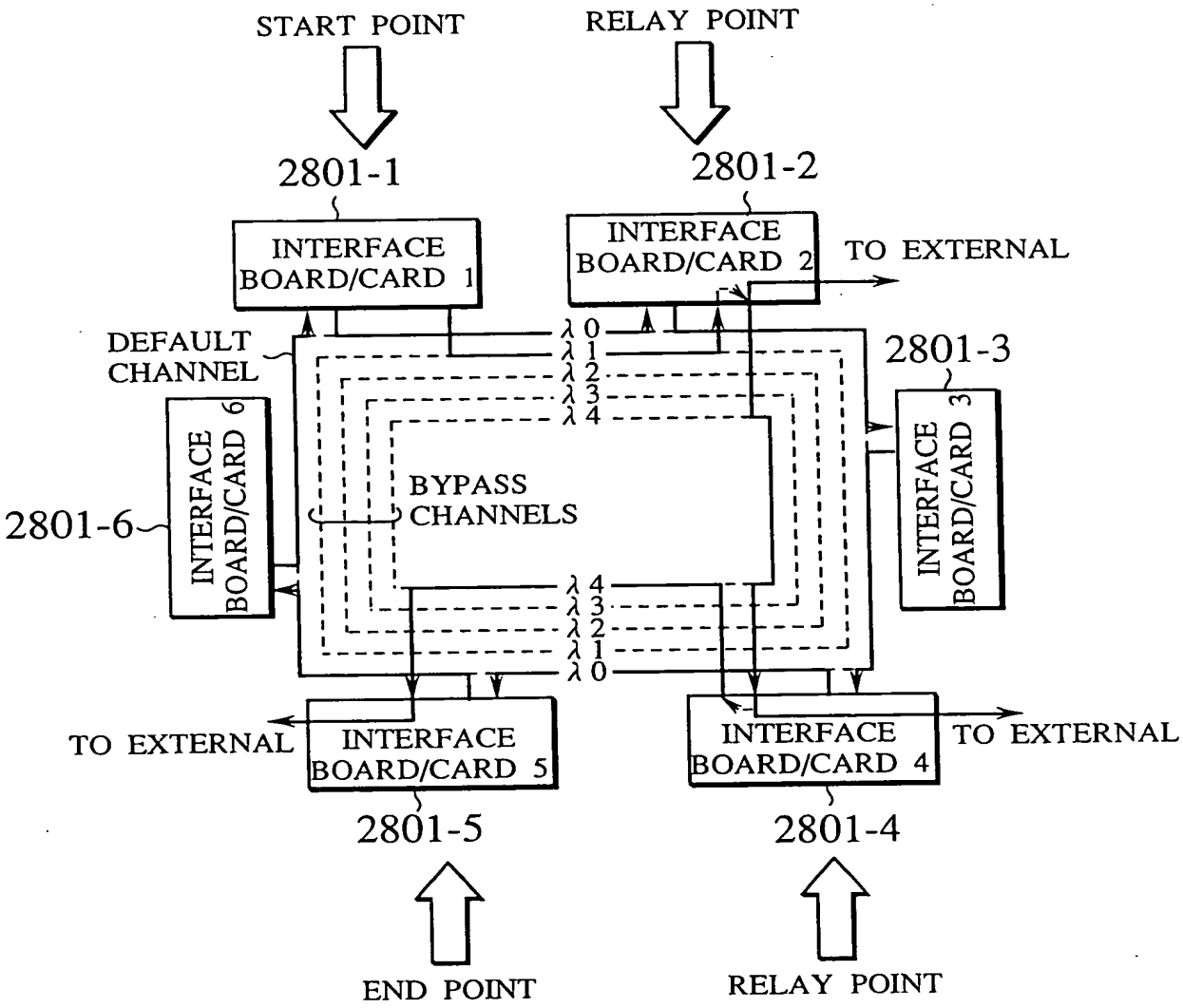

START POINT
RELAY POINT
2801-1
2801-2
INTERFACE BOARD/CARD 1
INTERFACE BOARD/CARD 2
TO EXTERNAL
DEFAULT CHANNEL
λ 0
λ 1
λ 2
λ 3
λ 4
2801-3
INTERFACE BOARD/CARD 3
INTERFACE BOARD/CARD 6
2801-6
BYPASS CHANNELS
λ 4
λ 3
λ 2
λ 1
λ 0
TO EXTERNAL
INTERFACE BOARD/CARD 5
INTERFACE BOARD/CARD 4
TO EXTERNAL
2801-5
2801-4
END POINT
RELAY POINT

FIG.55

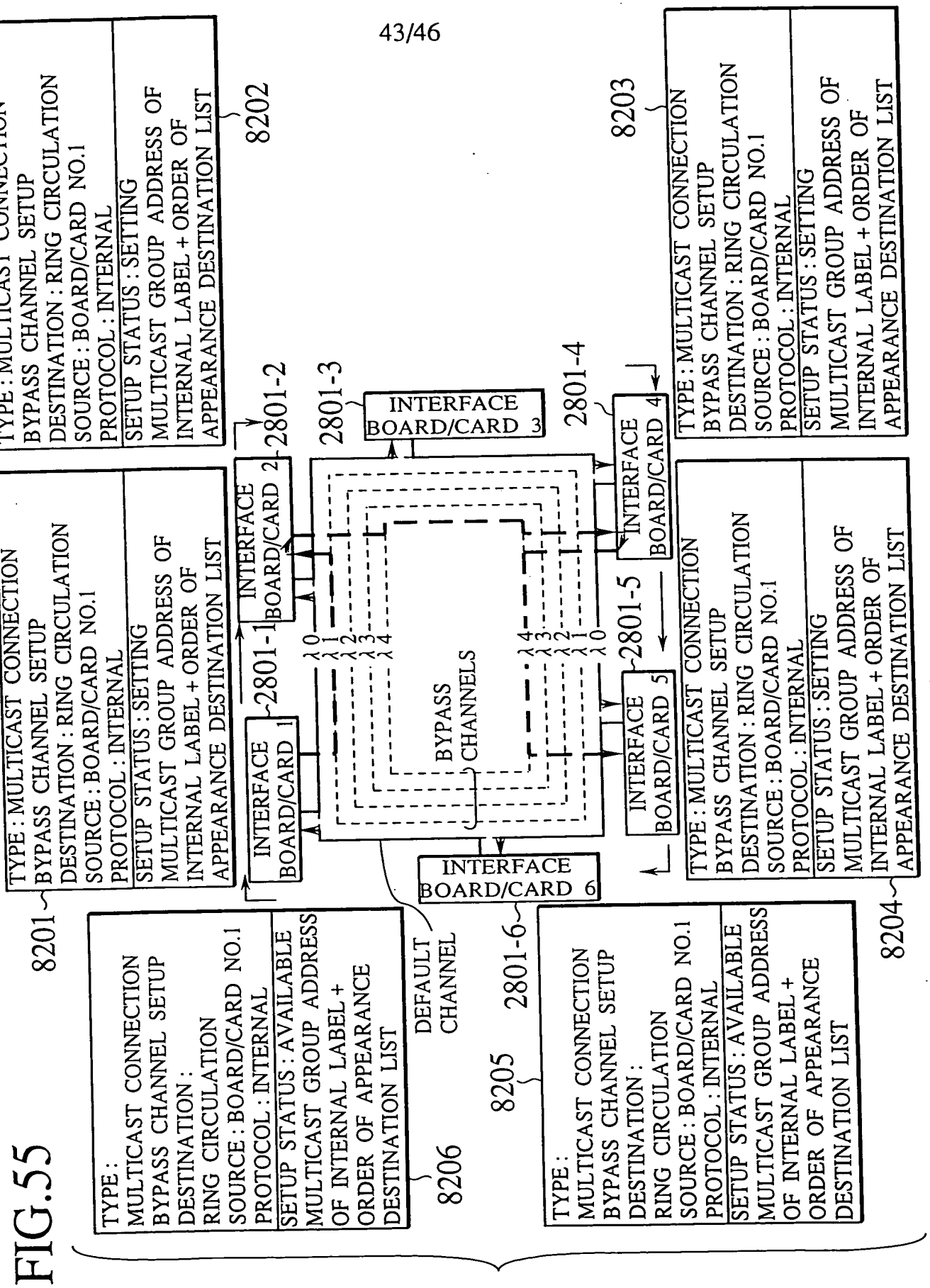

8201
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
SETUP STATUS : SETTING
MULTICAST GROUP ADDRESS OF
INTERNAL LABEL + ORDER OF
APPEARANCE DESTINATION LIST
8202
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
SETUP STATUS : SETTING
MULTICAST GROUP ADDRESS OF
INTERNAL LABEL + ORDER OF
APPEARANCE DESTINATION LIST
8203
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
SETUP STATUS : SETTING
MULTICAST GROUP ADDRESS OF
INTERNAL LABEL + ORDER OF
APPEARANCE DESTINATION LIST
8204
TYPE :
MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
SETUP STATUS : AVAILABLE
MULTICAST GROUP ADDRESS
OF INTERNAL LABEL +
ORDER OF APPEARANCE
DESTINATION LIST
8205
TYPE :
MULTICAST CONNECTION
BYPASS CHANNEL SETUP
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
SETUP STATUS : AVAILABLE
MULTICAST GROUP ADDRESS
OF INTERNAL LABEL +
ORDER OF APPEARANCE
DESTINATION LIST
8206
DEFAULT CHANNEL
2801-1
INTERFACE BOARD/CARD 1
2801-2
INTERFACE BOARD/CARD 2
2801-3
INTERFACE BOARD/CARD 3
2801-4
INTERFACE BOARD/CARD 4
2801-5
INTERFACE BOARD/CARD 5
2801-6
INTERFACE BOARD/CARD 6
BYPASS CHANNELS
λ0
λ1
λ2
λ3
λ4

FIG.56

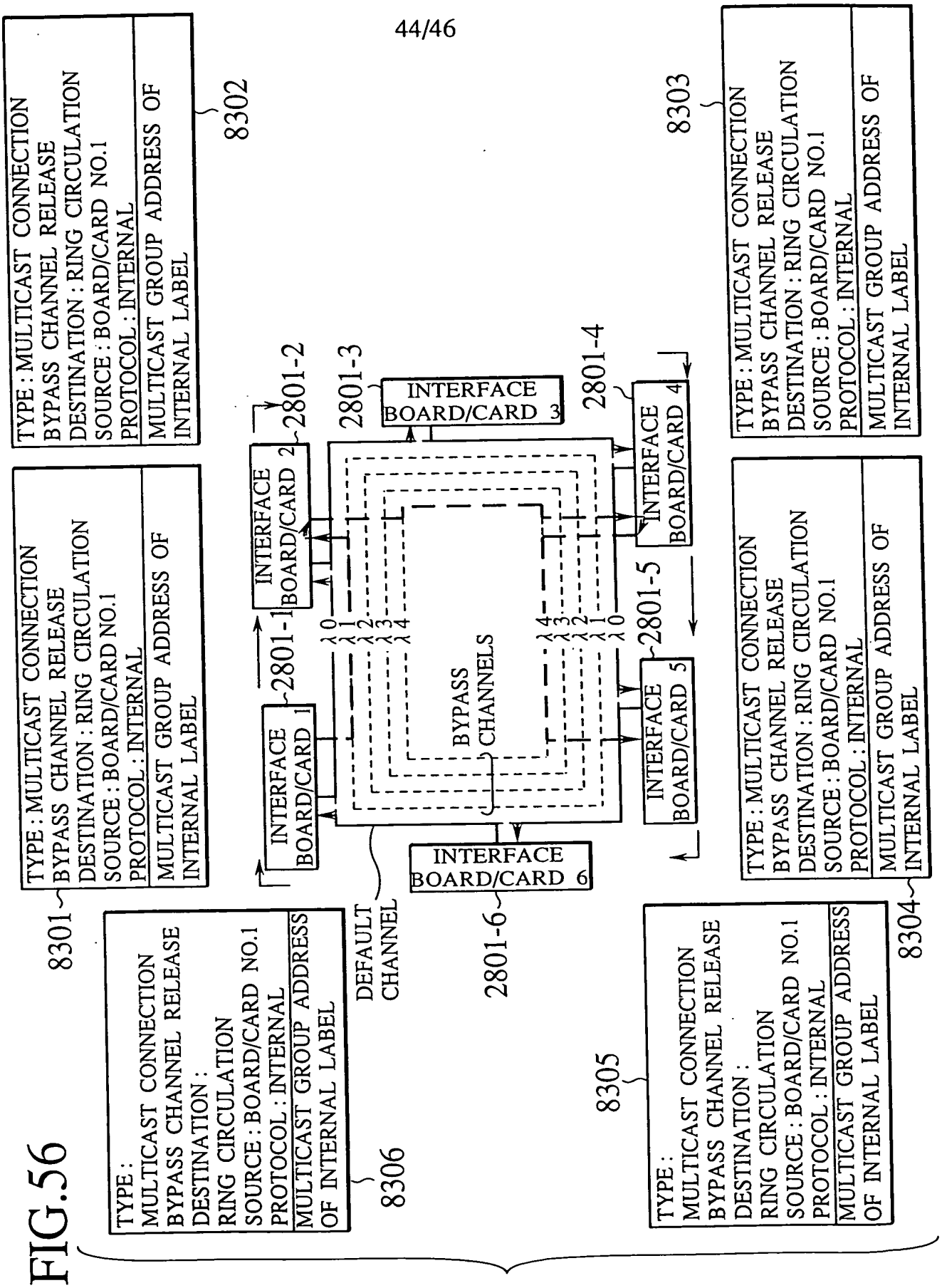

TYPE : MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8302
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8303
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8301
TYPE : MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION : RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8304
TYPE :
MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8306
TYPE :
MULTICAST CONNECTION
BYPASS CHANNEL RELEASE
DESTINATION :
RING CIRCULATION
SOURCE : BOARD/CARD NO.1
PROTOCOL : INTERNAL
MULTICAST GROUP ADDRESS OF INTERNAL LABEL
8305
INTERFACE BOARD/CARD 1
2801-1
INTERFACE BOARD/CARD 2
2801-2
INTERFACE BOARD/CARD 3
2801-3
INTERFACE BOARD/CARD 4
2801-4
INTERFACE BOARD/CARD 5
2801-5
INTERFACE BOARD/CARD 6
2801-6
BYPASS CHANNELS
λ0 λ1 λ2 λ3 λ4
λ4 λ3 λ2 λ1 λ0
DEFAULT CHANNEL

FIG.57
PRIOR ART

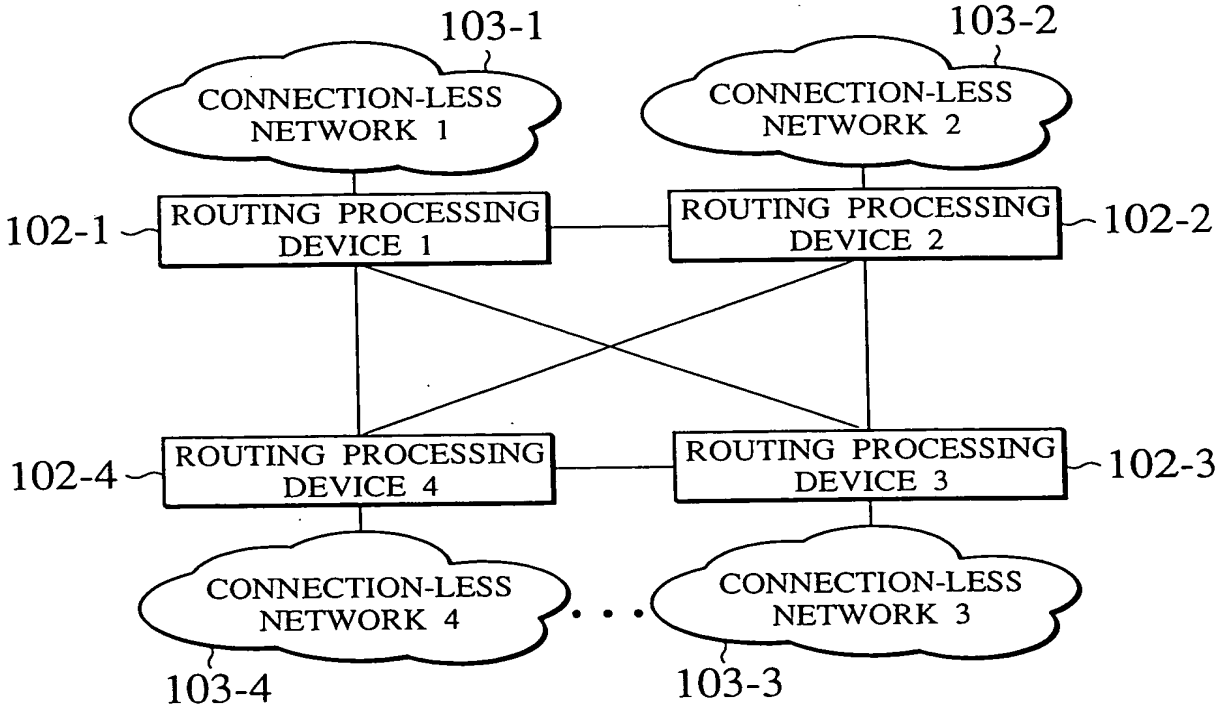
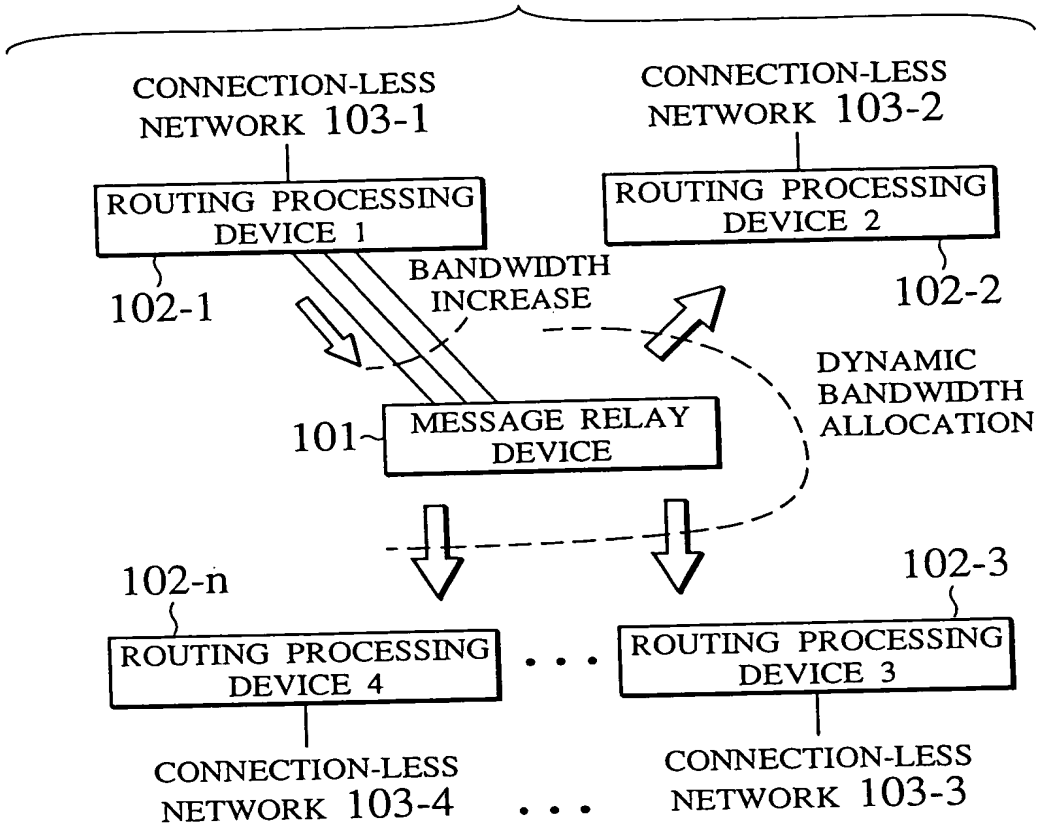


FIG.58


CONNECTION-LESS NETWORK 103-1
CONNECTION-LESS NETWORK 103-2
ROUTING PROCESSING DEVICE 1
ROUTING PROCESSING DEVICE 2
102-1
102-2
BANDWIDTH INCREASE
DYNAMIC BANDWIDTH ALLOCATION
101
MESSAGE RELAY DEVICE
102-n
102-3
ROUTING PROCESSING DEVICE 4
ROUTING PROCESSING DEVICE 3
CONNECTION-LESS NETWORK 103-4
CONNECTION-LESS NETWORK 103-3